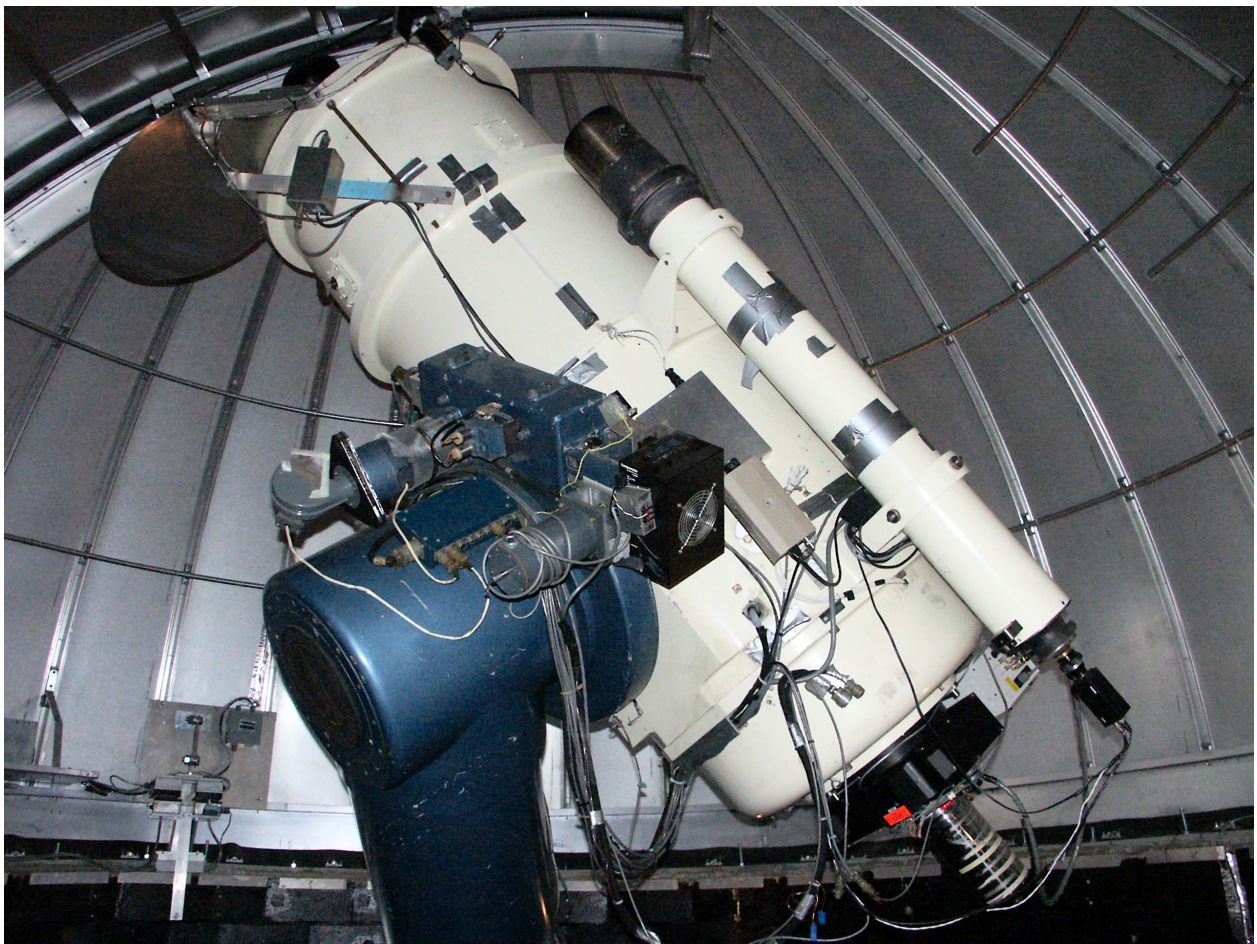# 0.6 METER TELESCOPE CONTROL MANUAL

February 2011

Revised

0.6 METER TELESCOPE CONTROL MANUAL

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0.6 METER TELESCOPE CONTROL MANUAL

OVERVIEW

The 0.6 meter telescope shown here at its 'stow' position with the 1K CCD camera, filter wheel and camera controller electronics box.

The 0.6 meter telescope control room, showing the operating desk with access to the three main operating computers; *Capella* (center) for science reduction and general user support, *Murzim* (right center) for telescope and the 1K CCD camera control and *TMO4K* (right), the 4K CCD camera system. *TMO4K* is switched along with *Canopus* (spare 1K CCD control), *Nash* (local server) and *Matar* (the weather system) from a control box next to the monitor. A fourth (utility

and internet) computer (*Cheleb*) appears in the lower left of the picture. There is a new LaserJet printer to the left of *Capella*.

Note that the control room is rather small, so restrict your observing team to no more than 3 to 4 people at any time.

Between *Murzim* and *TMO4K* is the NBS time clock and the RCA monitor for the Pulnix and 'dome' camera (described later). The 'time tags' attached to all CCD image header files are derived from an IRIG-B standard located in TM-27 and carried on the TMO network.

The 'control room' "EMERGENCY TELESCOPE SHUTDOWN" button is between *Capella* and *Murzim*. Use it **whenever** you suspect a serious telescope problem (described later).
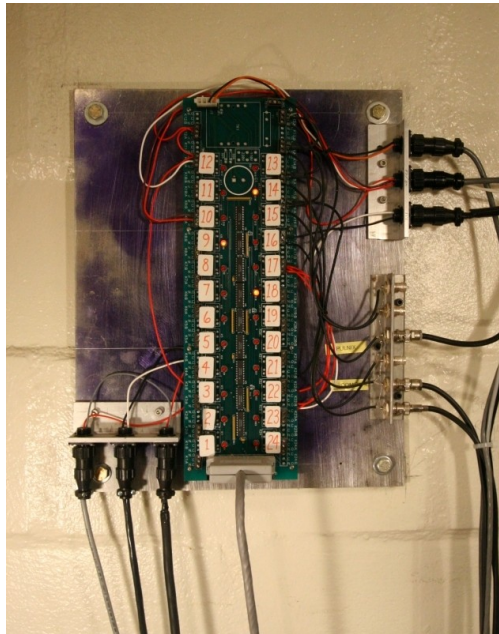
RELAY BOARD

On the wall above the main desk, is a control relay board that is used to activate various items through the telescope control computer, _Murzim_. During normal operations, you will hear and see indications of 'relay' operations. Some telescope 'clients use relays to turn on/off other equipment as needed, namely the TCP, Dome and Video clients. See 'Relay Board Settings'

1K CCD CAMERA CONFIGURATION & LN₂ COOLING

Although the TMO staff will have your particular equipment set-up before you arrive, here are a few pictures to view:
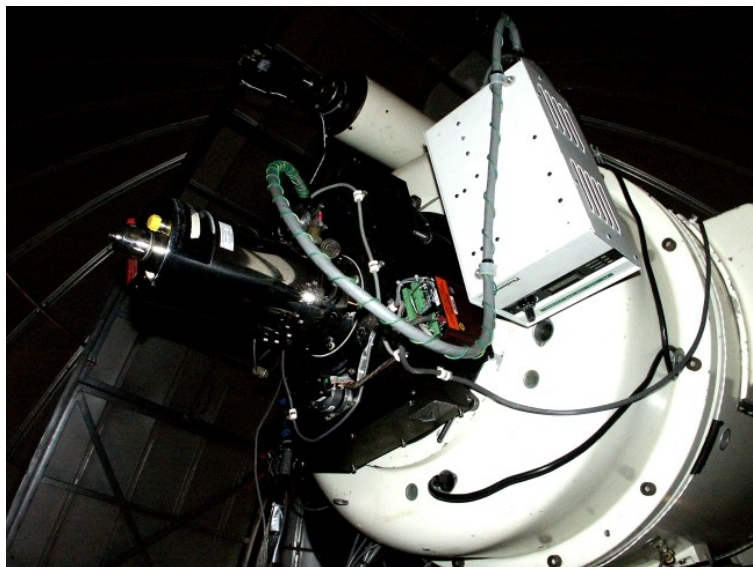
In this view, the white colored camera electronics control box in the upper right-center is always mounted on the base of the telescope. With the telescope in this 'stow' position, the front of the

box faces the floor; so one can look up at it to see if the unit is on/off, and/or if the camera is at operating temperature (-100ºC). The power to the unit is indicated by an **orange** LED, the camera not at temperature shows a **green** LED indicating that the camera is cooling (if LN_2 has been put in), or is not at temperature. If and when the camera is at temperature, there will be a faintly visible **red** LED indicating a small heater is cycling to keep the camera at temperature. On the upper side of this same box is the 'switch' to turn the unit on/off. Leave it on, even when your observation run is over.

In the center is the **black** rectangular 'filter box'. It has stepping motors that turn the two filter wheels (control units for these motors are at the lower-right and upper-left of this box). There are **green** LEDs for each controller, but they each have a small strip of **black** tape over them to keep the extra light subdued.

The 1K CCD camera and dewar (silver colored cylinder) housing attaches to the filter box, and also contains the internal LN_2 reservoir. The following image shows the camera from above being filled with LN2, using the large funnel provided for the users.

Site specific training is required by all users to handle and fill LN_2 in the TMO CCD cameras as needed. The LN_2 'round' shaped transfer dewar is used to fill a small insulated stainless steel thermos to pour into the funnel. Always use extreme caution when around LN_2.

The funnel is screwed into the access port on the end of the dewar for filling operations, with the telescope in the stowed position. The funnel is removed and replaced with a small red plastic plug when filling is complete. Do not screw the funnel or the plug in too tight as they may freeze in place.

5.

TELESCOPE AND CCD CAMERA COMPUTER OPERATIONS

In the Telescope Operations Control Room of TM-12, **LOCATE** the monitor with the computer name of 'MURZIM' written on top. This is the control computer for operating the 0.6 meter telescope and the 1K CCD camera. **MOVE** the 'track-ball' mouse to wake up the computer screen;

PRESS the Ctrl/Alt/Del keys simultaneously to start;

READ the JPL Security Banner (if you have not already done so), and then **CLICK** "OK";

TYPE in your own user name and password. Be sure that the "Log on to:" is set to TMOBS, otherwise you will not be able to log-in! The following screen will come up;

On login an observing log application should automatically launch, Please fill out the starting information and minimize it. You can finish filling out your observing run information and click the submit button.
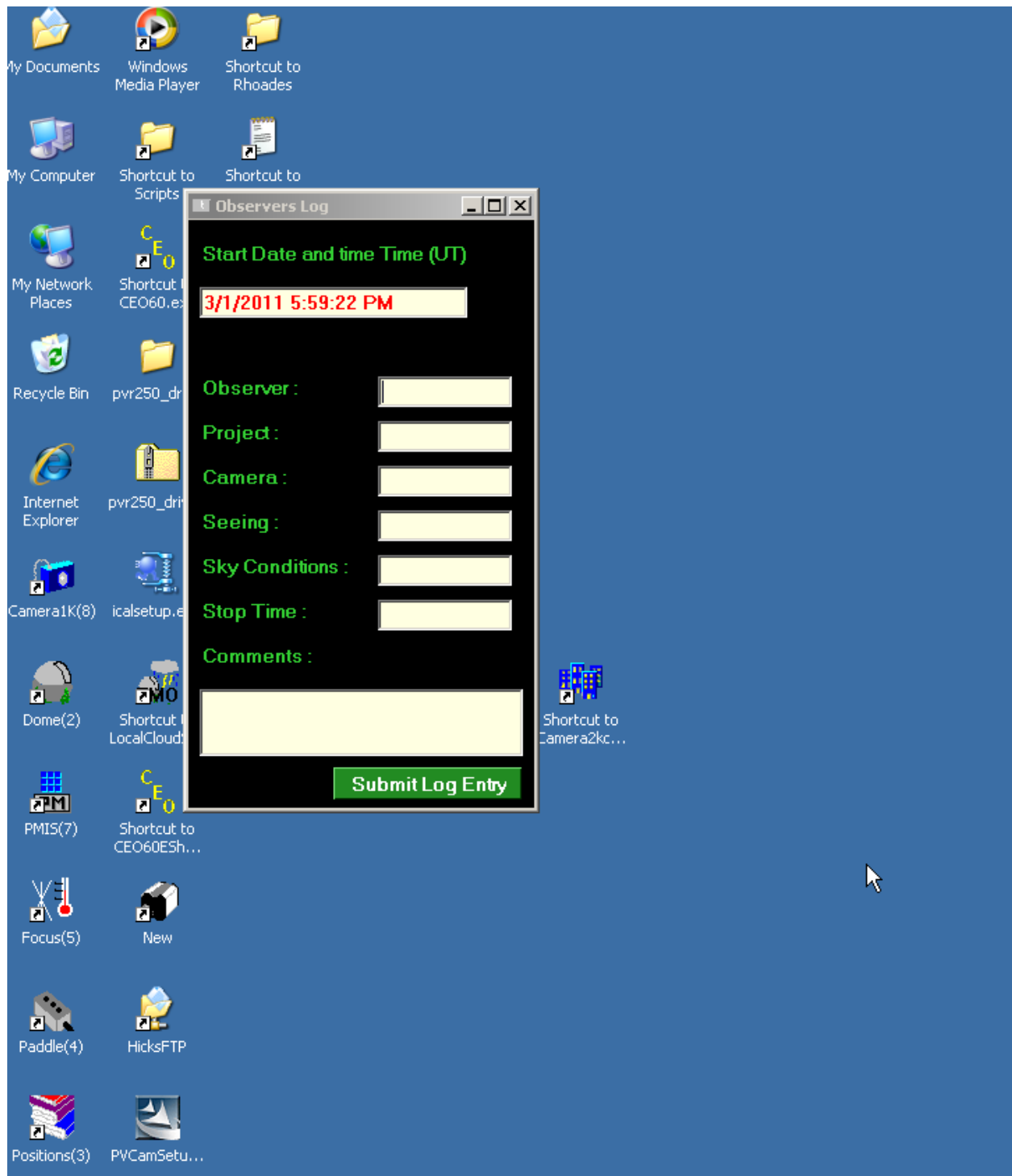
Although your log-in screen might appear differently, it should contain the necessary 'program client' icons for your operation. The 'clients' are specific programs that each control a different telescope function. Since the 1K CCD camera is the primary instrument on the 0.6m telescope, this manual will be specific to the operation of that instrument. **LOCATE** the eight program

client icons; they are numbered 1 thru 8, and **MUST** be brought up in numerical order. The functioning of each client is described below.

#1 TCP	This is the Telescope Control Program. It is used to position the telescope or to move it to the 'zenith' or 'stow' positions.
#2 DOME	This controls the dome opening, closing and rotation
#3 POSITIONS	Allows the user to input positions and tracking rates
#4 PADDLE	Allows the user to make small movements around a 'field' area
#5 FOCUS	Controls the telescope focus
#6 VIDEO	Displays field images on the RCA monitor using the 'Pulnix' video camera
#7 PMIS	Controls the 1K CCD camera software
#8 1K CAMERA	Allows user to image/name/save/set/change exposures and filters.

7.

DOUBLE-CLICK on #1, TCP. WAIT about 5 seconds, and the following screen will appear as;
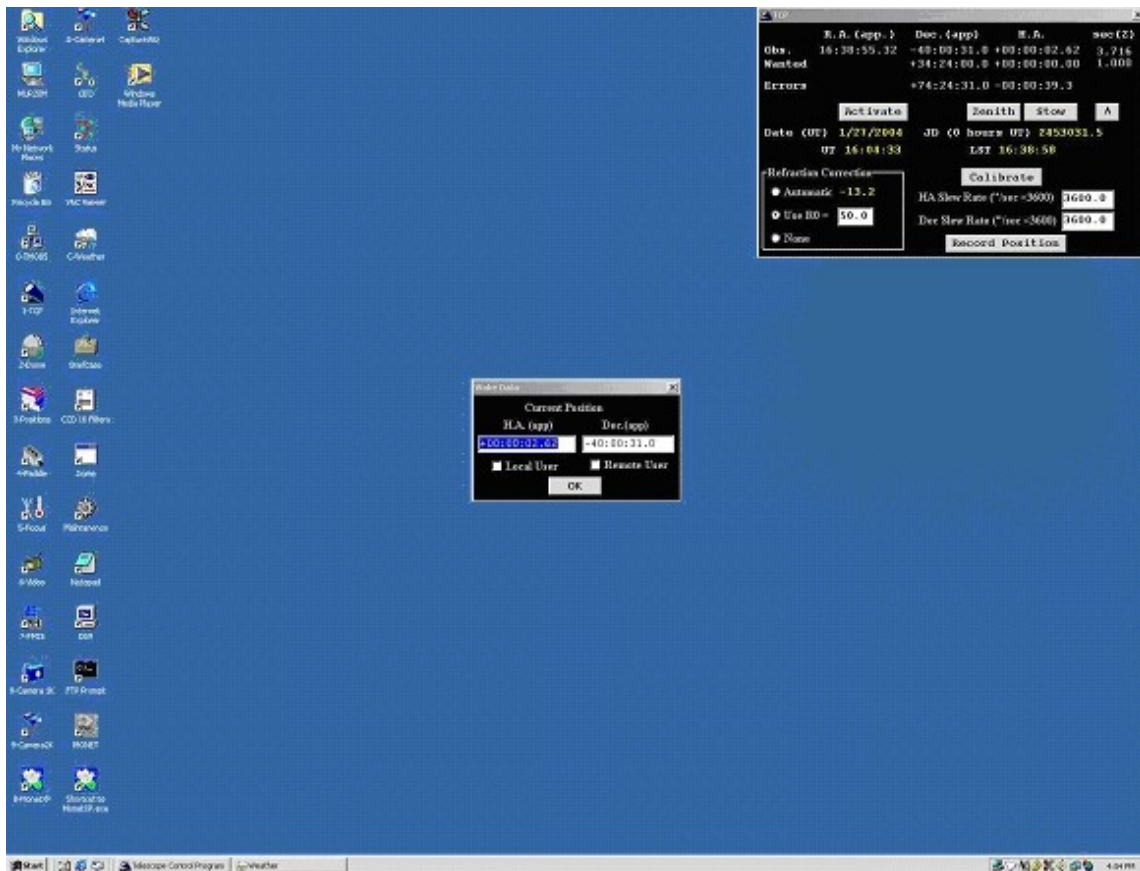
In the center of the screen will be the specific login box. If the telescope was last 'stowed' at the normal position of 0h HA and -40° of declination, the numbers will be very near to the following values: +00:00:00.00 HA and -40:00:00.0 Dec. (these values will never be exact)

If you are in the control room, **CHECK** the 'Local User' box, if you are running remotely from anywhere outside of the control room, **CHECK** the 'Remote User' box. Then **CLICK** "OK"

8.

You will now have a screen with just the 'TCP' client in the upper right-hand corner:

TCP's format should look exactly as above except many numbers will be different, such as the dates and times (both in yellow). Other numbers outside individual boxes will be gray in color. **NOTICE** that the 'Obs.' Dec & HA should be -40º and 00h HA (approximately). The 'sec(Z)' will be 3.717, the 'Wanted' positions should be +34º 24' and 00h HA (approximately). Ignore the 'R.A. (app.)' numbers for now. The 'Errors' will be +74º 24' and 00h HA (approximately). **DO NOT** change any items in TCP, as other clients will affect these during regular operations. To the far right, you will see a small box with an up-side-down 'V'. **CLICK** on this to minimize the entire "TCP" client box to appear as follows

The up-side-down 'V' now appears as a regular 'V'. Click on this again (if necessary) to bring TCP back to the full size (only as necessary, such as to calibrate the telescope: described later).

**9.**

DOUBLE-CLICK on #2, Dome:

When the 'Dome' client comes up, all the default settings will be shown. **NOTE** that the word 'Home' is shown in **green**. This means the dome is in the home position, 90º +/- 2º, ready to receive commands to open the 'Slit' or 'Shutter'. Since nearly all operations call for the entire 'Slit" to be opened, **CLICK** on the word 'Open" to the right of "Slit is Shut". The 'Shutter' will now start to open, followed a few seconds later by the 'Door' opening. The **blue** color bars will show the progress of the entire opening. Once opened the 'Slit', 'Shutter' and 'Door' will show as 'Open'. CLICK the 'Open' box (to the right of 'Cover is Shut'); the 'Mirror Cover')in front of the telescope tube) will open. Wait till the 'Cover' is opened before accessing anything else!

When the slit opens, the shutter slides back across the top of the dome and the door opens out and downward. There is a flap on the shutter that over laps the door when closed to keep the rain out. Thus the shutter must start opening slightly ahead of the door, and closes slightly after it. If it is particularly windy and the chosen targets are at modes zenith distance (<Xxº), the observer may wish to consider only opening the shutter and not the door.

DOUBLE-CLICK on #3, Positions;
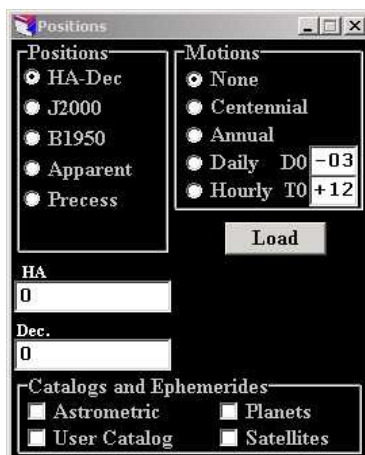
The 'Positions' client will come up this way. If the user is planning normal work, **CHECK** the J2000 box. If you will track non-sidereal objects, **CHECK** the 'Hourly' box and put in the UT time in T0 (ignore the 'D0' box). Now select 'S' or ' " ' for your rates in the drop-down menu. Change the UT time only when a new ephemeris position is entered, or a new object is selected.

The user can also select from the 'User Catalog', the JPL 'Planets' catalog, or a 'Satellites' ephemeris listing. Whenever the user selects a particular object from any of the different catalogs, **ALWAYS** "Load" from the specific catalog window, or the 'Astrometric Catalog Search' window. Whatever is 'loaded' will the appear in TCP as selected as a new 'Wanted' position in the TCP client.

Note: Entering the correct value for T0 is critical for observations of moving objects, such as comets and asteroids. T0 is the UT time for which the entered ephemeris position is valid. The

telescope will track on the moving object at the specific R.A. and Dec rates. If an incorrect value of T0 is entered, the telescope will offset along the track of the moving object by rates x (T-T0), where T is the current UT time. T0 is not important for fixed objects, so remember to set the target rates to zero.
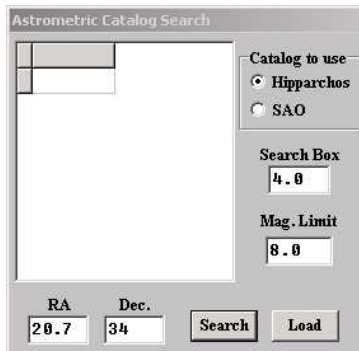
LEFT: Default 'Positions' box.

RIGHT:
Enter approx. R.A. & Dec, then do a 'Search' for stars. Highlight an object, then **CLICK** the 'Load' box
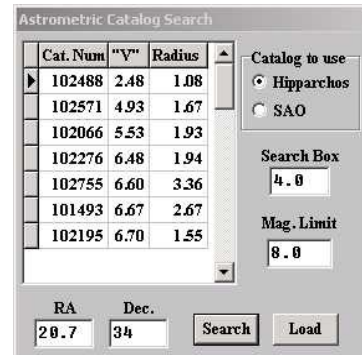
The stars found here are usually used for telescope calibration purposes. To now select specific items, **CLICK** on 'User Catalog'. The following window will appear. Select the catalog you wish to use and click 'Open':
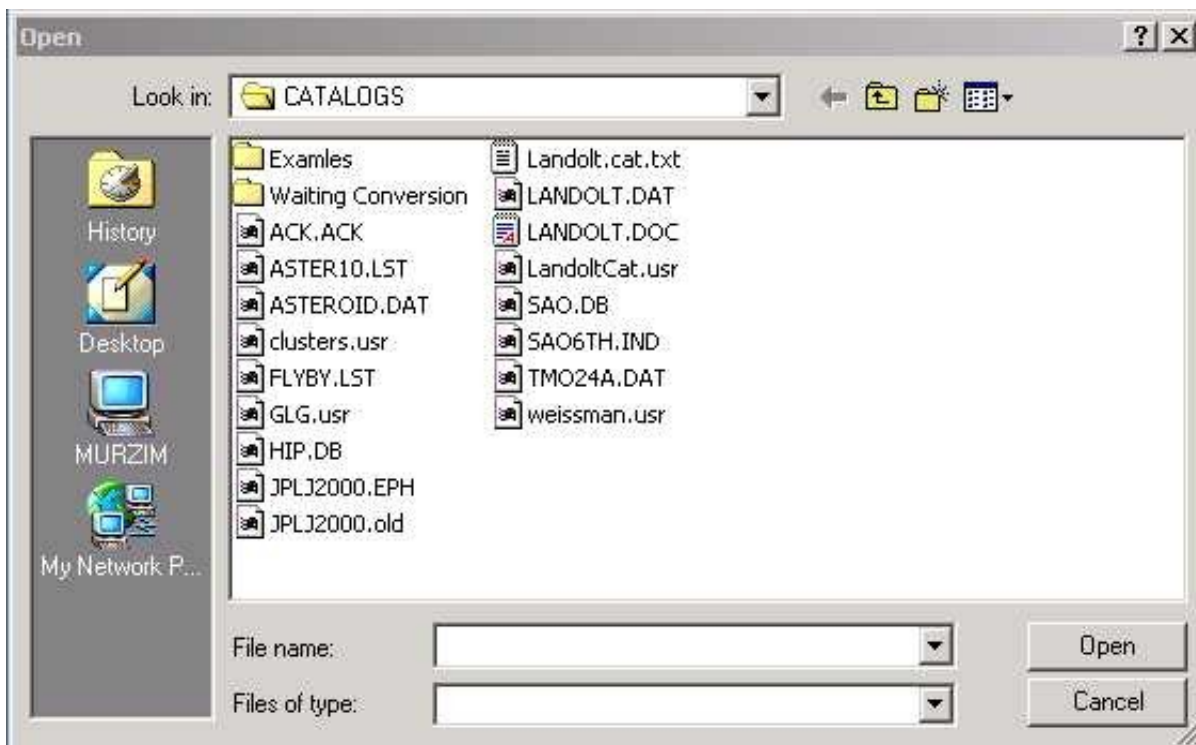
11.

Here is the "LandoltCat.usr";   Here is the listing from the 'Planets' ephemerides;

Object	R. A.	RA rate	Dec.	Dec rate	Mag.	T0	Comment
00	00:55:57.00	0.	+01:11:03.0	0.	12.96	4	stars in SA 92
03	03:53:45.00	0.	-00:02:40.0	0.	10.80	5	stars in SA 95
06	06:52:14.50	0.	-00:19:02.0	0.	11.93	6	stars in SA 98
07	07:24:14.50	0.	-00:31:56.0	0.	11.48	8	stars surrounding RU 14
09	09:56:11.00	0.	-00:12:59.0	0.	12.58	3	stars in SA 101
12	12:42:26.00	0.	-00:39:30.0	0.	13.48	3	stars in SA 104
15	15:39:14.00	0.	-00:14:38.0	0.	12.12	4	stars in SA 107
17	17:44:15.00	0.	-00:02:24.0	0.	12.44	3	stars in SA 109
18	18:43:13.00	0.	+00:29:13.0	0.	11.31	6	stars in SA 110
21	21:43:26.50	0.	+00:16:59.0	0.	12.34	4	stars in SA 113
22	22:16:23.00	0.	-00:21:45.0	0.	12.71	4	stars surrounding PG 22
G1	15:39:35.00	0.	-00:15:06.0	0.	14.25	SA107	(inc. 9 stars)
G2	18:43:13.70	0.	+00:32:27.0	0.	13.7	SA110	(inc. 6 stars)
G3	22:41:38.80	0.	+01:12:14.0	0.	14.8	SA114	(inc. 8 stars)

Equinox and equator of catalog: 2000
Motions are annual

Load Position

| Object	R. A.	Dec.	R (a.u.)	RV (km/s)
Mercury	19:01:24.26	-22:42:11.6	01.1676	+24.3
Venus	23:06:06.94	-07:03:13.1	01.1539	-10.8
Sun	20:35:01.33	-18:40:52.4	00.9846	+00.2
Mars	01:32:57.50	+10:18:20.2	01.3468	+15.9
Jupiter	11:18:10.40	+05:56:21.4	04.6350	-18.4
Saturn	06:33:34.13	+22:35:55.0	08.1574	+13.9
Uranus	22:14:26.17	-11:41:02.6	20.9272	+12.9
Neptune	21:00:23.72	-17:02:54.6	31.0525	+03.4
Pluto	17:24:41.16	-14:31:29.7	31.4318	-20.2
Moon	00:45:25.72	+01:41:14.5	00.0026	+00.1

Geocentric quantities for 0 hours UT

Load Position

DOUBLE-CLICK on # 4, The Paddle
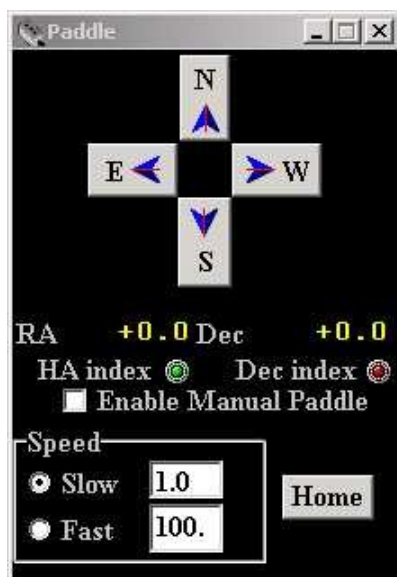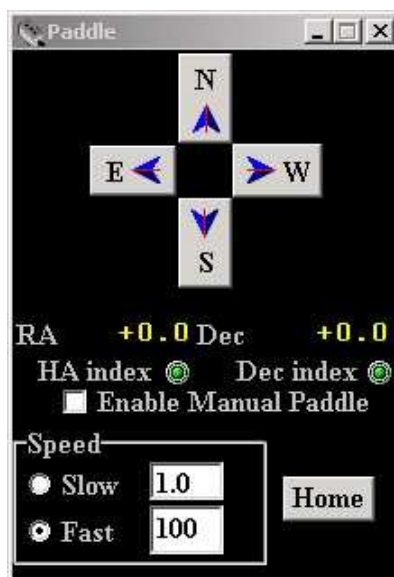
A: Default   **B: TCP at Zenith**   **C: Rates/Offsets changed**
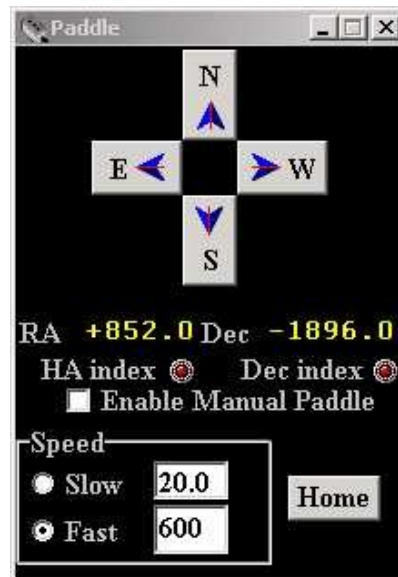
The Paddle operation allows the user to make small adjustments to the actual pointing of the telescope. In the above images, '**A**' represents the default appearance when first brought up. The telescope has two small position markers physically mounted on the polar and declination axes. If the telescope ever moves without computer control inputs, (this can happen if the computer 'crashes' while the telescope is 'slewing' in either or both axes), eventually the user will have to manually relocate some accurate position (explained in detail later) to calibrate the telescope. Look carefully and note the 'HA index' and 'Dec index' color symbols. The two 'markers' are located at the zenith position (+34º 24' 00" declination) and the meridian position (00h 00m 00s HA). In '**A**', the telescope is on the meridian, but not at the zenith, so only the HA index symbol is **green**. In '**B**', the telescope has been moved to the zenith, and thus both of the symbols are **green**. In '**C**', the telescope in neither on the meridian or at the zenith, thus the two **red** symbols.

If you are not sure of the telescope's position, a sure check is to slew the telescope to the zenith. Both symbols should be **green**. If not, then see the section on **Telescope Calibration**.

12.

Whenever using the paddle, always remember to 'Home' the paddle position when moving to a

new object, otherwise the paddle offsets will be added (or subtracted) to the new object's position, making the new object difficult or impossible to find (depending upon how large the paddle offsets were before moving). If, however, you move to a new object, then notice you forgot to 'Home' the paddle offsets, merely **CLICK** on 'Home' anytime, even while the telescope is slewing.

The paddle allows the user to select two speeds of motion; slow and fast. The rates are in arc seconds/second of time. In '**C**', the rates have been changed from 1.0 to 20.0 in 'Slow', and 100 to 600 in 'Fast'. You cannot select a paddle speed faster that 1799.0 in either axis. Rarely does The observer need rates faster than 600!

There is an 'Enable Manual Paddle' check box, but this is only used for telescope maintenance and coude operations by TMO staff. Do NOT select this, otherwise normal operation will not work.

DOUBLE-CLICK on #5, The Focus client:
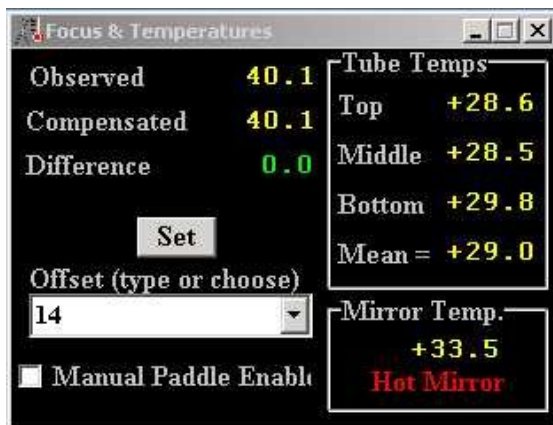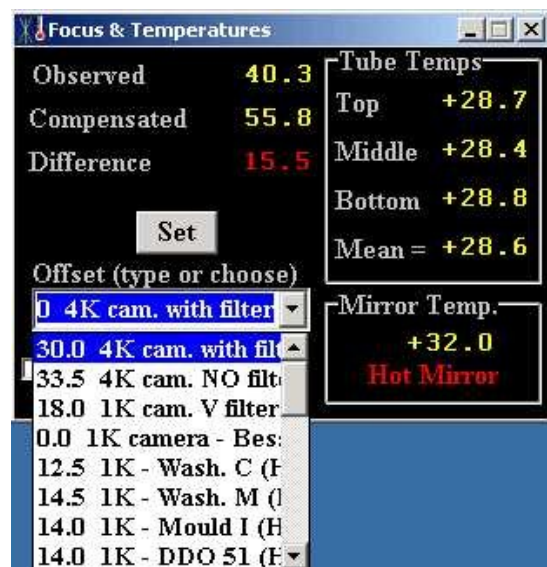
Figure A	Figure B

The focus client enables the user to set and maintain focus during normal operations, without the need to re-focus using camera images. Each camera and their various filters have specific set focus numbers. In the 'Offset (type or choose)' box, either type in the number you know to be correct for your particular setup (figure A), or choose one from the drop-down menu (figure B) selection. After making whatever choice, **CLICK** on the 'Set' box. The 'Difference' will be 0.0 or very close to that value. You may notice that multiple 'clicks' on the 'Set' box will be necessary to get the lowest value (near to or equal to 0.0). As the night progresses, the ambient temperature will change, so it will be necessary to **CLICK** on 'Set' whenever the value gets higher than about +/-0.4. The number will also change (flicker) by small amounts. This is not a concern, so just watch the slower change and click 'Set' whenever necessary. If you forget to 'Set', you will eventually get out-of-focus CCD images. Do NOT type in values shown for the 'Observed' and/or 'Compensated' values, as these numbers are merely a scale from the indexed

13.

'zero' in the software. There is a maintenance program to re-index the focus zero-point when the program crashes (seldom), but only TMO staff can access this program.

The 'temperature' values shown on the right are relative to the telescope tube and mirror, and are used to calculate the program's zero-point. The 'Mirror Temp.' will almost always show a 'Hot Mirror'. The difference between the 'Mirror Temp' and the tube 'Mean' will normally fall between 0.0 and 8.0. Usually, but not always, the closer the mirror temperature is to the 'Mean' temperature, the better the seeing will be.

The focus values used over many years of checking show that the various values do NOT differ significantly. User reports that they do have never been substantiated except when the client was found to have crashed (without the user's knowledge) or the focus 'zero-point' needed the TMO staff to re-set the client. Focus is generally an individual interpretation, but the TMO staff takes accurate measurements during periods of excellent seeing to re-confirm the values used. FWHM values of sub-arc/second 'seeing' reveal that changes less than +/-0.2 in the values used are, indeed, very difficult to detect. In 2 arc second 'seeing', values of +/-0.8 are difficult to detect.

DOUBLE-CLICK on #6, the Video:
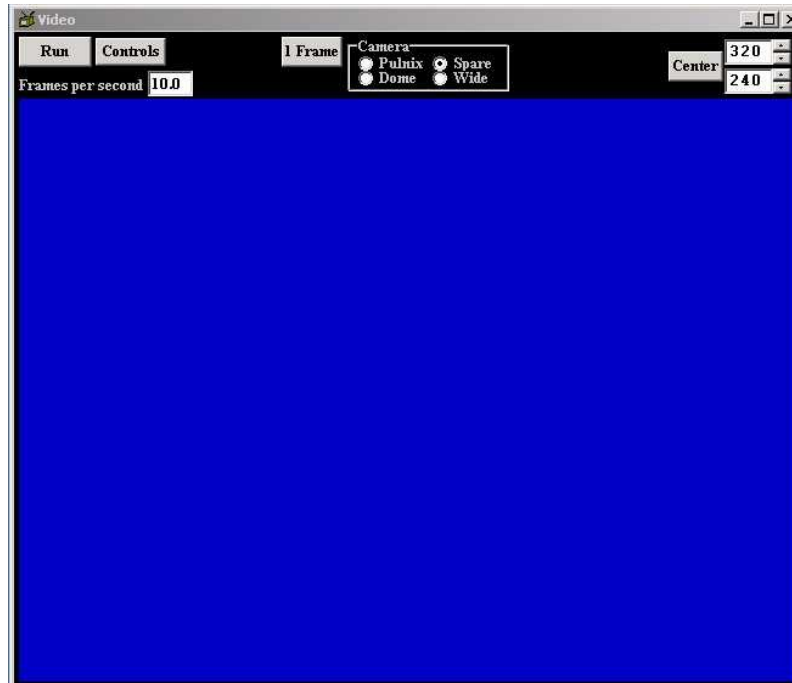
The video client controls two different cameras in the telescope dome. The 'Pulnix' camera is attached to the 6-inch refractor, and provides a 16 X 20 arc minute field-of-view as seen with the RCA monitor (turn on if using) to the right of *Murzim's* monitor (above the NBS clock). **NEVER** turn on the 'Pulnix' camera if the dome lights are on, or if the sky is too bright (during twilight periods). The second camera is called the 'Dome' camera, and is a small video camera that allows the user to see where the telescope is pointing; the dome walls, the slit opening, etc. It is not very sensitive but **DON'T** point it to the sun (as you will note that this has been done twice before). The RCA monitor shows either camera (not both at the same time) by individual selection using the video client. The video client has additional options that allow the user to view a single frame at a time (from either camera), but since it takes considerable bandwidth to show these images, most observers use the RCA monitor. The 'Spare' and 'Wide' cameras do

not yet exist. When selecting the 'Dome' camera, the user then (and only then) has access to the dome calibration lights, sometimes used to take dome 'flats'. On the extreme upper right side, one can change the centering 'cross' as seen in the video client itself (not the RCA monitor). If the 'dome' camera is on, the user has access to the 'Calibration Lamps' mounted on the front end of the scope. These can be used for 'dome' flats if needed. **DO NOT** leave these lamps on when using the Pulnix camera! If you attempt to 'Run' the video client, you will be asked about your bandwidth capabilities. If you are taking lots of CCD camera images, and are observing, you should not attempt to 'Run' any of the video cameras in the client itself….Just use the RCA monitor to display 'real-time' images.
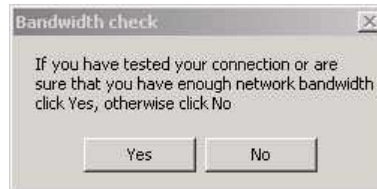
DOUBLE-CLICK on #7, PMIS. Ignore the 'Display Check' box which will appear and disappear shortly.

If PMIS comes up 'clean', you will see the following two boxes:

15.
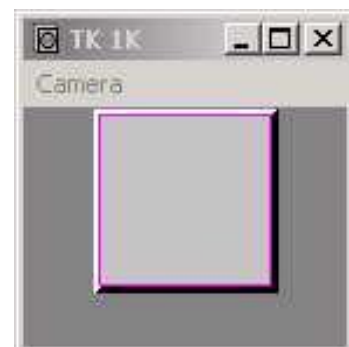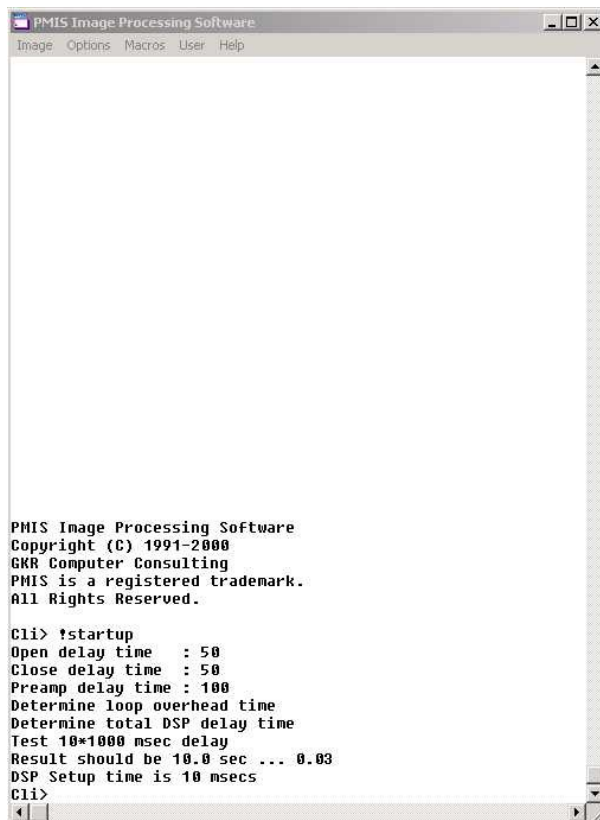
LOOK at the above left illustration carefully. If you see anything different than what is shown, you need to close down the client and try again (something like this for example):

```
Cli> !startup
Open delay time   : 50
Close delay time  : 50
Preamp delay time : 100
Camera interface error
Camera Error : The AT200 is unresponsive or missing.
```

The illustration on the right is the 'Camera' CCD chip format. Leave it visible on the desktop. There will be more on this shortly, as well as under the #7 PMIS anomalies section.
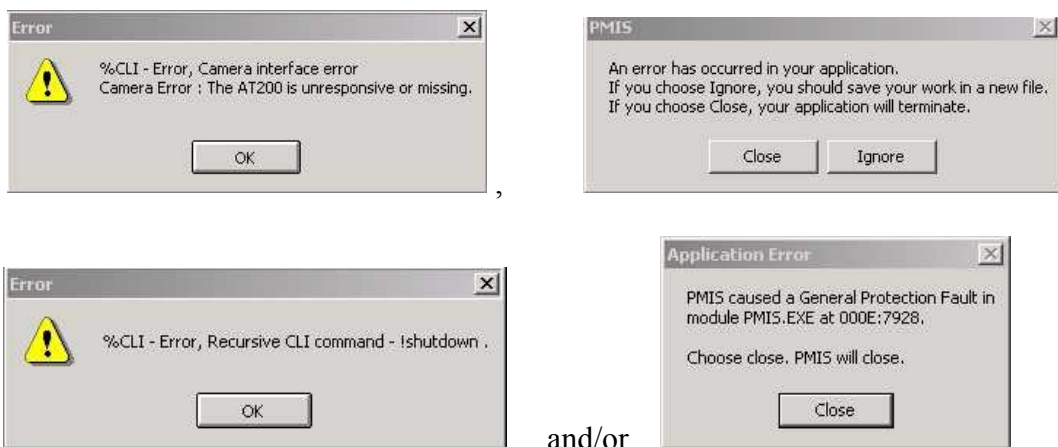
If you need to close down the client, you will get one or more possible 'error' messages shown as follows as you attempt to close PMIS:

In all cases, **CLICK** 'OK' or 'Close'.

During the 'close-down' process you may get the following message. Merely **CLICK** 'No'.

Re-starting PMIS might take several attempts to get a 'clean' start. This is a PMIS software glitch, and TMO staff members have experienced a maximum of four attemps to get a 'clean' start after the original attempt failed. Patience here may be necessary. Until you get a completely 'clean' and working start-up, close down all error messages until PMIS looks like the full image (on the previous page). Once you have a 'clean' PMIS, minimize (Do **NOT** close) it by **CLICKING** on the '-' button at the upper right.

DOUBLE-CLICK on #8, the 1K Camera Client. As this client comes up, it will automatically initialize the filter wheel, through three steps. After about 18 seconds the word 'Ready' will appear in the upper left corner.

16.
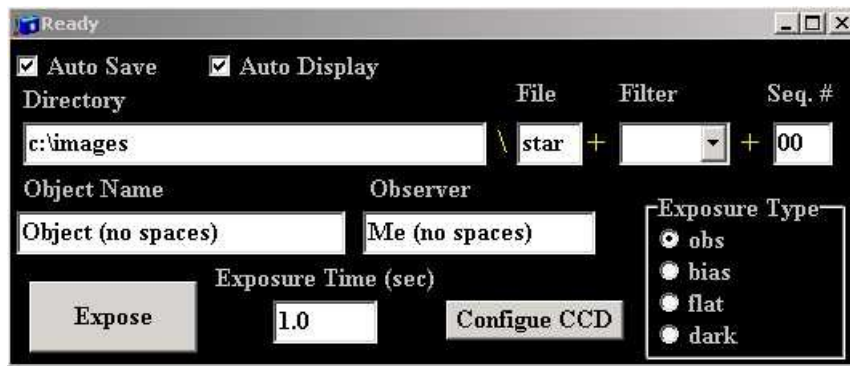
As you set up this client, you will want to test your settings. It is highly recommended that you **UN-CLICK** the 'Auto Save' check mark. This will prevent you from saving 'test' images into your image directory (be sure to **CLICK** 'Auto Save' before your first 'science' image). You will notice another window marked, "Monet 1k Camera Version' will also appear (see more detail on this client later).
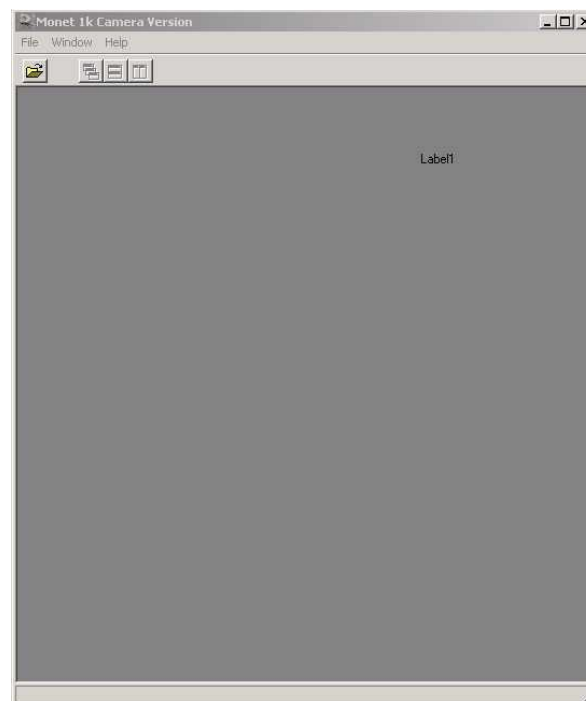
IGNORE the 'Label1' in the window. This is the 'sub-client' to the actual display window that will come up each time an image is taken. Now, back to the 1K Camera Client:

17.
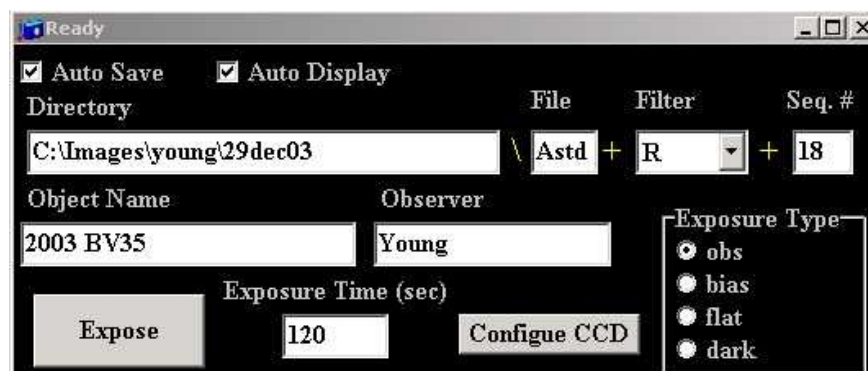
In the above illustration, the various boxes have been changed for a particular set of normal circumstances. 'Auto Save' (to automatically save the image to your directory) and 'Auto Display' (to display your image automatically on the computer screen) can be set to your needs. In the 'Directory' box, one starts out with C:\Images………………….. To complete this area, **CLICK** once inside this box to bring up the following (**DON'T** attempt to change the imbedded 'File name', "fake"):

Now **SELECT** your 'image' directory user name 'folder' by highlighting it only. Then **CLICK** on the 'Open' box TWICE! Now your user name directory will show after 'C:\Images'. Now click once in the blank portion of the 'Directory' box, and the following will show:
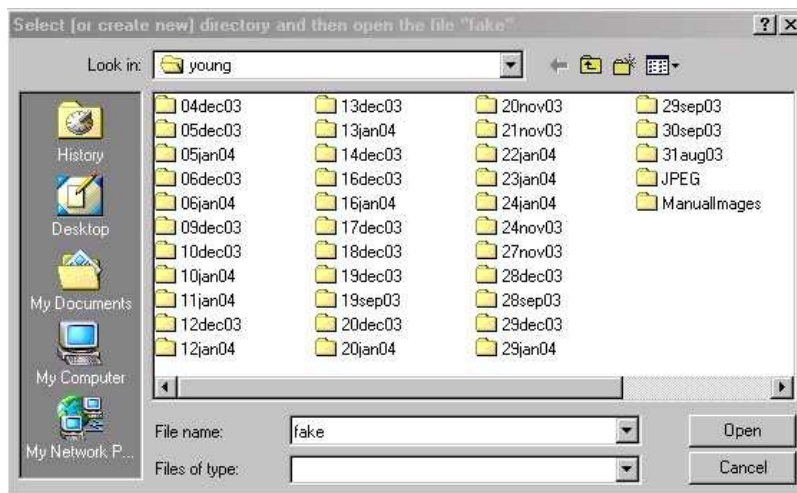
This will show the user's folders (usually by date format) that are currently stored. If the needed 'folder' for your new observations is already there, merely highlight it only, then **CLICK** on the 'Open' box TWICE! Now your date directory will show after C:\Images\(your user name). Remember to ignore the imbedded 'File name', "fake", as it will disappear on its own. However, if you need to make a new directory, **CLICK** once on the 'Create New Folder' icon.
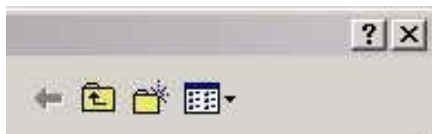
The 'Create New Folder' icon is the smallest yellow folder.

18.

Name the folder, and **PRESS** the 'enter' key. Now click in the blank portion of the box once, then highlight the directory you just made, and finally **CLICK** on the 'Open' box TWICE! The 'Directory' should now look something like this

Directory
C:\Images\young\18dec03

The 'Filter' box has a 'drop-down' menu showing the various filters one can select; Open, U, B, V, R, I and Index. Select the needed filter (or 'Ind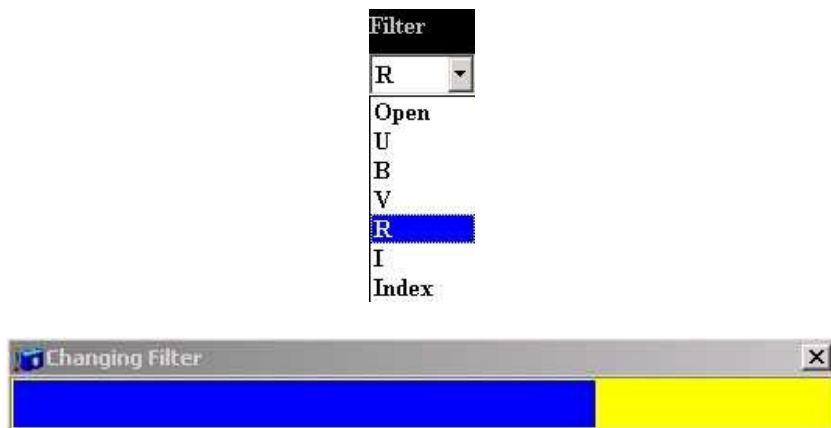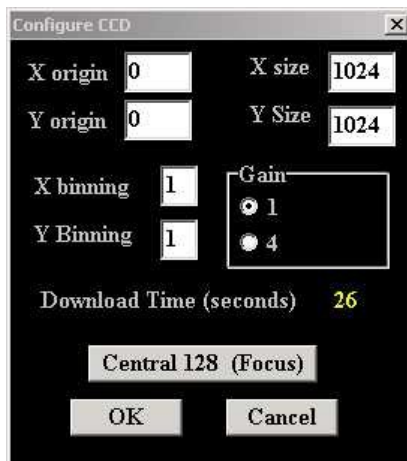ex' to re-calibrate the filter wheel). The 'Open' and 'Index' positions select the same filter, currently a narrow-band methane filter. The following illustrations show the filter 'dropdown' menu, and the filter 'change' progress

Filter
R
Open
U
B
V
R
I
Index

Changing Filter

The 'Seq.#' shows the image number, sequentially and automatically changed with each image taken (only when the 'Auto Save' box is checked). You can type in any three digit number. Enter whatever you wish in your 'Object Name' as well as the 'Observer' name(s). These will both be included in the FITS header record for each image. Enter the 'Exposure Time (sec)'. Beware that there is NO way to abort an exposure once started, so if one enters a very high number (say, over 1200 seconds) by mistake and starts the exposure, the only way to abort is to close down the 1K Camera and PMIS clients, or you must just wait. Ten minute (600 second) exposures are common, 20 minutes (1200 second) are not. Under the 'Exposure Type', the user can select 'obs' for regular imaging (requires the user to type in the 'File' name – a maximum of 4 letters/numbers), as well as 'bias', 'flat' and 'dark' frames. The latter three will place the appropriate 'File' name automatically. To 'Configure' the CCD will be rare, but if necessary,

Configure CCD

X origin 0   X size 1024
Y origin 0   Y Size 1024

X binning 1   Gain
Y Binning 1   ● 1
                  ● 4

Download Time (seconds)   26

Central 128 (Focus)

OK   Cancel

19.

The 'Configure' client allows the user to select the CCD gain; 1 or 4 (1 is the default). Also the 'download' time is shown in seconds, this changes when binning is invoked. The CCD chip readout area can also be changed, and even specific to where on the chip surface. The 'Central 128 (Focus)' box allows the user to do small (and short) frames for checking the focus. **ALWAYS** return the 'Configure' box settings to the values shown here. Once the 'OK' box is 'clicked', the client will disappear.

The actual readout area of the CCD chip is shown by the following small boxes:

| Figure A | Figure B | Figure C |

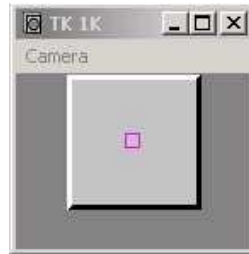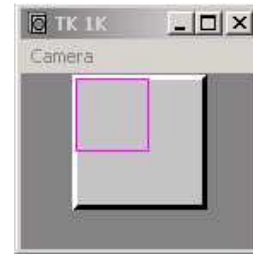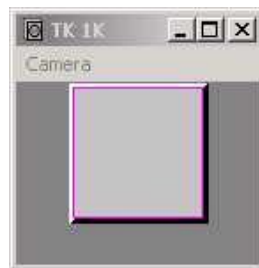Figure A shows the full CCD chip being used; figure B shows the 'Focus' 128 x 128 center, and figure C shows a 600x600 pixel area attached to the upper left-hand corner (X = 0, Y = 1024).

Look at the 'chip' display again,

If you **CLICK** on 'Camera', you will get a small 'drop-down' menu with "Initialize…", 'Acquisition Area…" and "Focus Help" (not illustrated).

#1, "Initialize…"

20.
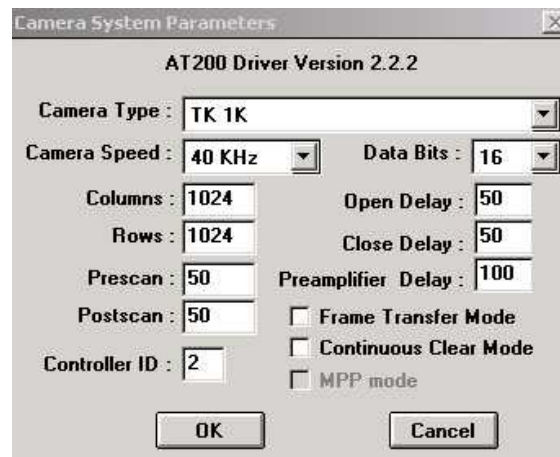
#2, "Acquisition…":
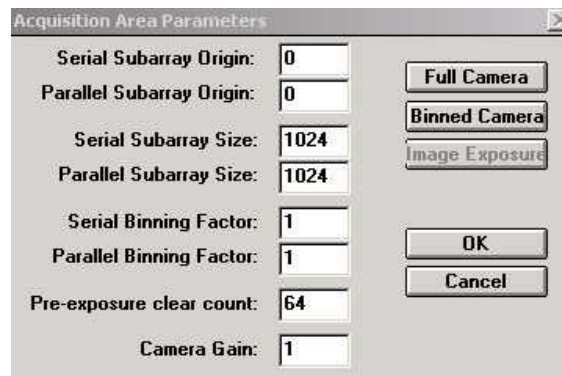
In the #1, "Initialize…", Do **NOT** change the 'Camera Type'; it is already set at the "TK 1K" setting! Also the 'Camera Speed' is already set correctly to "40 KHz." Do **NOT** change these values!

The Focus help really does nothing! Do **NOT** look at the 'Camera' menu during your actual observations. It will cause you to lose the exposure (and image) you are taking. You will **NOT** be able to recover the image and you will get the following display during your image readout: completely blank, and **NO** image will be saved
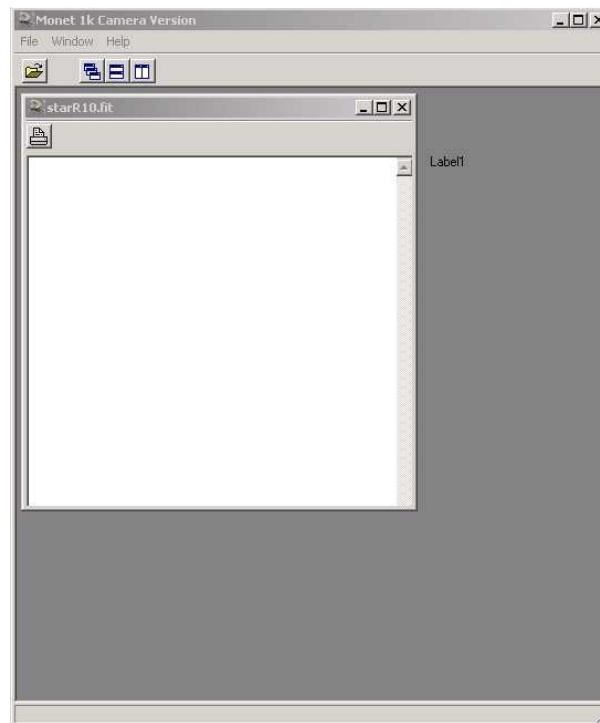
Once you exit the 'Camera' menu, operations will continue as normal. It will be extremely rare that you will need at access the 'Camera' menu, however, beware of this consequence! When everything is set the way you wish, you can begin the exposure by clicking 'Expose' in the 1K Camera Client window. The progress of the exposure can be watched in the PMIS window and will be shown by a solid bar. Pre-exposure processes will take ~X seconds, and the post-exposure readout and writing the file to disk (for a full frame, unbinned image) will take ~30 seconds.

TELESCOPE CALIBRATION

Normal Calibration Routine

A normal and important procedure every time the telescope is used, is for the observer to calibrate the telescope with a known star at the beginning of the night. With all the clients running, one simply queries the 'Position' client for a star using the 'Astrometric Catalog Search'. Generally this is best done by selecting a star near the zenith, and slewing the telescope to it. Using the Pulnix video camera and observing the selected star's position on the RCA video monitor, one will know immediately how well the telescope is pointing correctly (calibrated). The following image of the monitor was taken to simulate a 'star' several arc minutes from the center of the field;
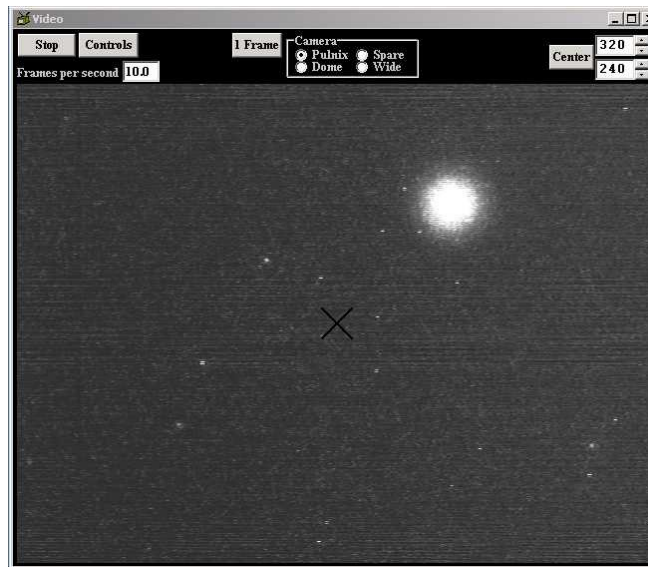
The above image is a screen capture of the Pulnix field of view in the 'Video' client while running. The large 'black' X is the center of the field. In this view, the star is about 4 arc minutes to the northwest of the center of the field. Although one can do this procedure by using the RCA monitor alone, I couldn't take a screen capture image of the RCA monitor. Selecting the 'fast' speed on the Paddle client, move the telescope until the star is centered on the 'black' X. Then press the 'Calibrate' button in the TCP client;

22.
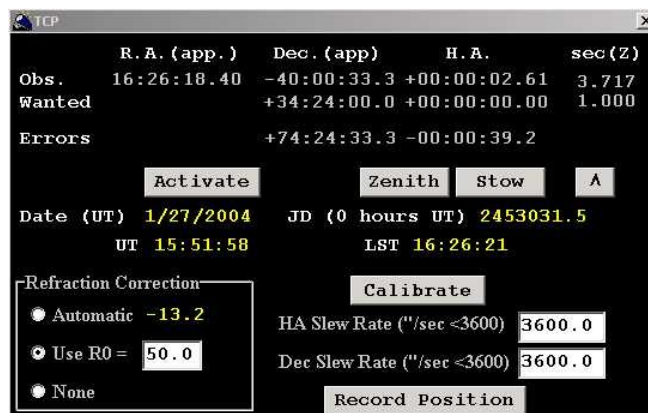
You will now have the image display/telescope 'locked' into the correct position, and your pointing accuracy will remain within 10-20 arc seconds for the entire sky above 2 air masses. The image should look like this:
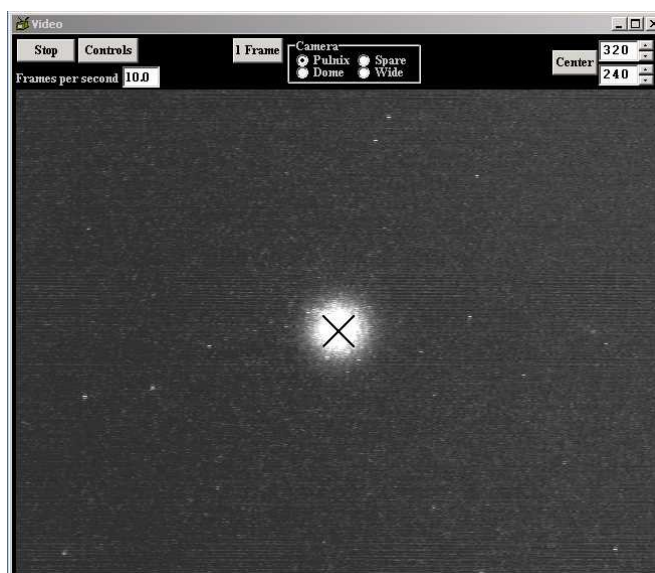
If you choose to calibrate on a bright star near your faint object (target), that is perfectly fine, but remember that if you do with a considerable distance from the zenith, further selctions during the remainder of the night might show much higher inaccuracies. It is not that uncommon to start an observation of an object at greater than 2 air masses. If you calibrate the telescope in this circumstance, errors will be into the arc minutes (especially with a telescope 'slew' all the way across the sky…to another object. Doing this still is not a problem, as long as you just merely do another 'calibration' with a star near the next target.

As you use the paddle to move the telescope for calibration, you will notice offsets in both axes:
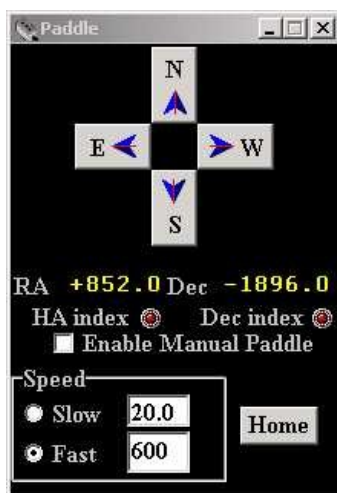
Once you click on the 'Calibrate' button, the offsets will both return to '0.0'. A reminder here is to always remember to 'Home' the paddle client when merely moving the telescope to make your field-of-view what you want the camera to see. If you forget to do this between targets, you will soon learn your object(s) is off the amount of the paddle offsets. You can 'Home' the paddle client at anytime, except when taking an image, and/or even while slewing the telescope.

<u>Advanced Telescope and Pointing Calibration</u>

Normally, the observer will never find a 'calibration' star off of the RCA monitor by using the Pulnix camera. If this does happen, usually a phone call to the TMO staff 'on-call' for your run will do this more complex procedure.

The procedure is to move the telescope to the 'Zenith', and then look at the two **red** LED axis calibration lights (one on the polar axis behind the H.A. counterweight on the east side, the other one on the Dec axis straight above the floor). Here are images of them;
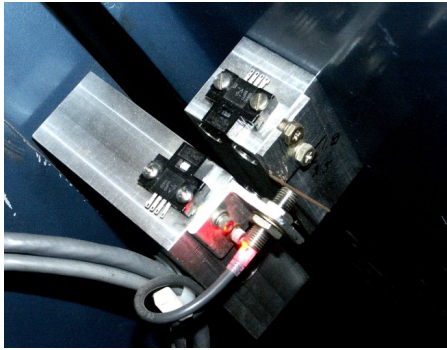
R.A. Axis
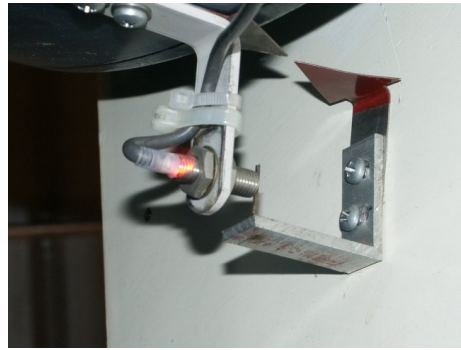
Dec Axis

If either or both of the **red** 'LEDs' are not on, you will have to determine which way to move the telescope (using the 'fast' speed on the paddle client). Move the telescope using the paddle (one axis at a time) until the **red** LED comes on (repeat for the other axis if necessary). The **red** LEDs have some 'slop' to their actual center point with regards to the sensor and 'pointer rods' used for proper positioning. Try to get the sensor pickup and the 'pointer rods' centered as well as possible.

You will most likely have to change the paddle 'fast' speed to a reasonably high number, say about 1200.0. An additional aid, will be to carefully look at the 'Paddle' client for the two **green** symbols:
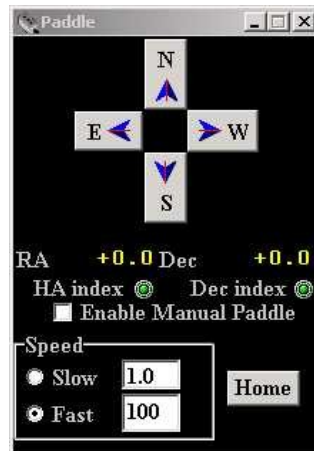
Now, using RCA monitor and the Pulnix camera, and do a normal 'calibration routine' with a bright star. You should be all okay now. This can be a difficult and timely procedure, so don't hesitate to call the TMO staff member who is 'on-call'.

24.

DESKTOP SCREEN EXAMPLE

Although everyone will want their desktop to their own liking, I have included an example of the way you might like to place the various 'clients' to be seen and used as you observe. Placement of the clients that are used most often should be more visible: this will save you time when you are taking data:
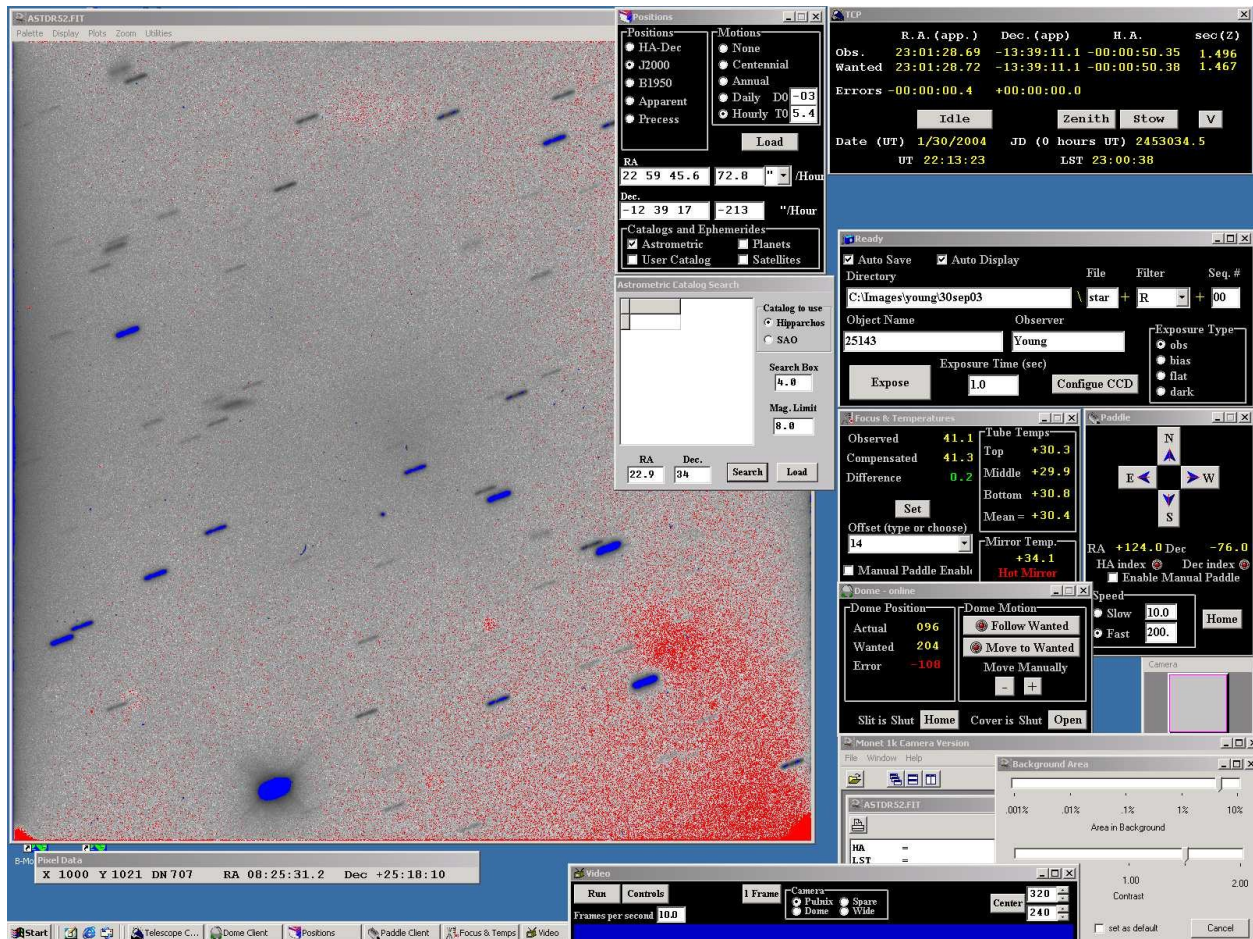
If you look carefully, you will find all the various clients (or parts of them) in a working order I prefer. Since this is just an example, not all the clients illustrated here are in use; ie, just shown for the potential placement position. You can arrange the 'clients' anyway you choose for your particular set-up and operations. Having all of them as visible as possible will save you time in the long run.

All of the clients are also on the bottom 'toolbar', and many users just minimize some to keep their particular desktop 'clean'. As images are displayed, they always 'show' in front of any other client (except TCP). TCP was specifically designed so as to always appear on top of any other client. This is for safety reasons. If you need immediate access to TCP (to 'Idle' the slew or tracking), it needs to always be visible. Notice also that TCP cannot be minimized! The 1K CCD camera client can be minimized, but has the same characteristics as TCP; ie, nothing can hide it except TCP. However, TCP can be covered by the camera client. The small narrow space between TCP and the camera client (in the above illustration) is for the 'exposure/ download' progress bar described shortly).

25.

TAKING IMAGES

When taking images, if you have the 'Auto Display' checked in the 1K Camera Client, the image(s) will be displayed in 'Monet' similar to this; (an image of Asteroid 25143, Itokawa is displayed here: the telescope was tracking on the moving asteroid). The default image is always displayed in the 'negative' sense (this image has been 'stretched'). Colors, intensities, spots and general appearance are described later:
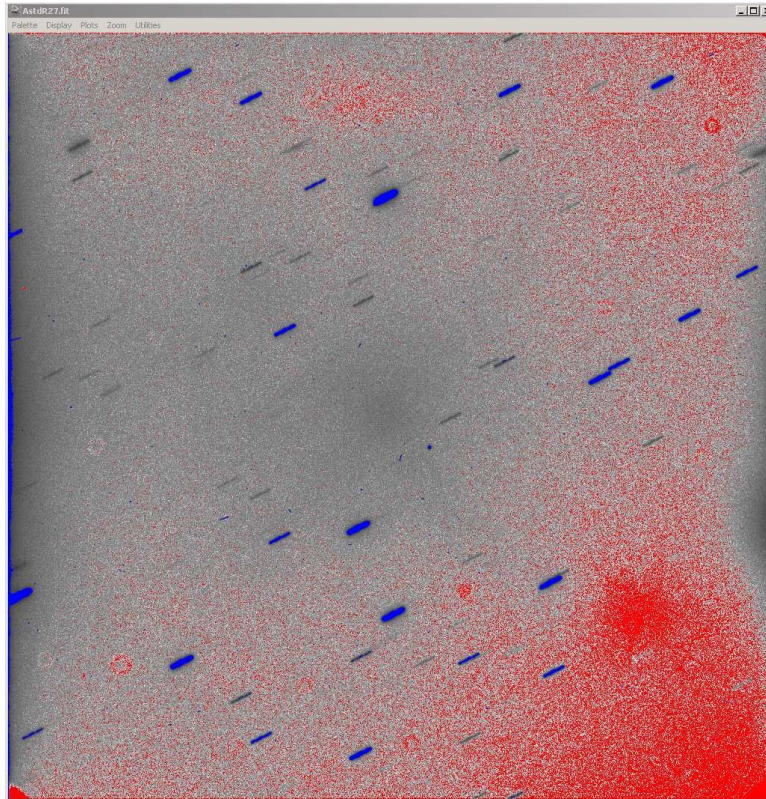
The full display with all pixels is shown. In the upper right-hand corner of Monet, you will see:

#1: Selecting the 'Palette', the user can change colors or change the image to a 'positive' display.

#2: In the 'Display' mode, the following user control box appears;

26.
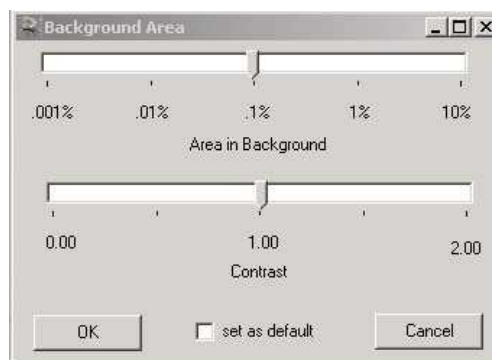
By moving the upper slider bar the user can 'stretch' the background. The default is 0.1%. Moving the slider bar to the right improves most images. The lower slider bar default is a contrast of 1.0. Moving this slider bar to the right greatly increases the contrast. **Caution:** If the background is relatively high, moving the contrast bar to the extreme right will cause 'Monet' to crash! (multiple errors!).

In this case you need to close the 1K Camera Client, and re-open it (which returns Monet), but you might need to use 'Task Manager' to stop the program (see #1 TCP, under **ANOMALIES**).

#3: Under 'Plots', the user can produce a 'Histogram', a 'Column' plot and/or a 'Row' plot.

#4: In 'Zoom', the default is an image with a 1:1 ratio. This shows all pixels. The user can select 1:4, 1:2, 1:1, 2:1 and 4:1 to either magnify or reduce the normal default display.

#5: In 'Utilities', the user can save the image as a JPEG file (to your directory) or apply a flat field. The 'Print' utility does not work.

If you 'left-click' the mouse anywhere in the image, the following display will show;

When moving the mouse 'cursor' around the image, the 'X' and 'Y' coordinates and 'DN' levels are displayed for wherever the 'cursor' is moved. The approximate RA and Dec will also be displayed (these values are very good, but not astrometrically accurate).

If you 'right-click' the mouse over a 'point' source on the display (such as a star, asteroid or comet), the following window will appear:

27.
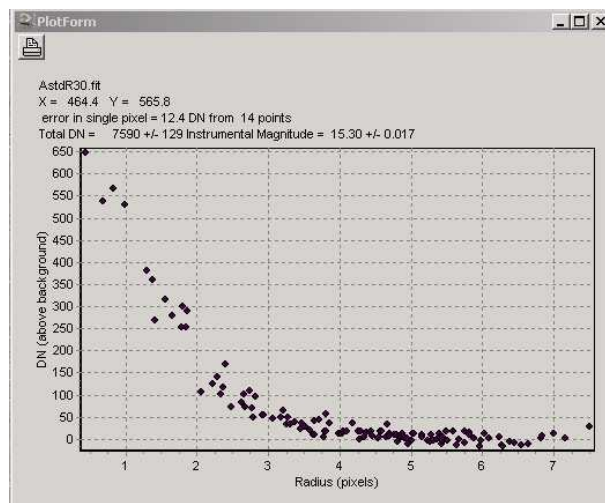
In the 'PlotForm' window, the image file is identified, the 'X' and 'Y' coordinates of the selected object are shown, the 'Total DN', and an approximate 'Instrumental Magnitude' is calculated. Since the telescope plate scale is about 0.52 arc seconds per pixel, the 'Atmospheric Seeing' can be estimated (FWHM) using the lower scale. In the above plot, the 'seeing' is about 1.4 arc seconds (1.4 pixels x 2 x 0.52"/pixel). Whenever an exposure is taken, a small 'sliding' bar for 'Exposure Progress' is displayed (the blue is the exposure progression, moving to the right);

EXPOSURE AND IMAGE DOWNLOAD PROGRESS
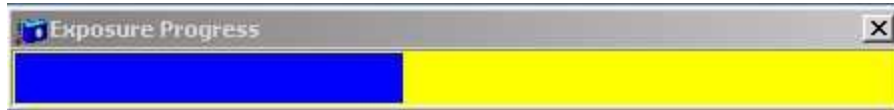
When the exposure is completed, the same display changes to the 'Download Progress', and shows the 30 second progress time (the blue is the download progression, moving to the right);
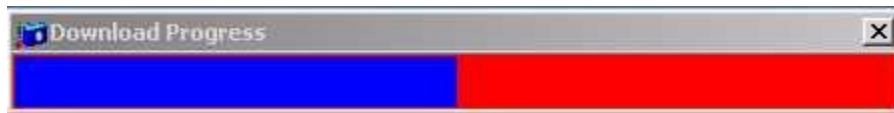
Each image 'download' takes 27 seconds, but the 'bar' is set to 30 seconds (in the software). When the image has been loaded (saved), then 'Monet' displays the image in about 12 seconds. During this 'Download Progress', it is highly recommended that you do **NOT** use or move the cursor, or type anything into *Murzim*! Leave the computer alone. Any action can cause sufficient 'network' disturbance to cause part of your image to be lost!

As the image is being prepared for display, the 'Monet 1K Camera Version' box will show the complete FITS 'header file' in a separate 'scrolling box' inside.

28.
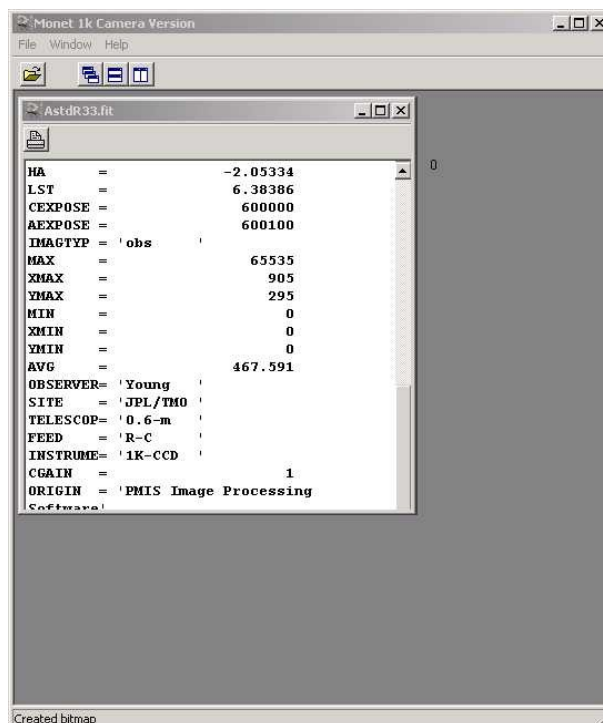
The user can 'scroll' the right-side vertical 'bar' to read the various information if needed.

Watching and using the various clients while observing is quite simple. TCP actually displays where the telescope is, the UT Date and time, the LST (Local Sidereal Time), the Julian Date, and the 'sec (Z)' value commonly referred to approximately the 'air mass' value. After any 'Load' is done from the various 'Position' selections, the user merely 'Activates' the TCP to slew (and eventually track) to the object.

DOME ROTATION

With the 'Dome' client now needed to keep the telescope looking out the slit, notice the two values for the 'Wanted' and 'Actual' positions. These numbers approximate the azimuth of the slit opening in degrees (0 = North; 90 = East; 180 = South; 270 = West).

| Figure A | Figure B |

In figure A, the dome is correctly positioned for the telescope, as the 'Actual' and 'Wanted' positions are the same (no 'Error'). There are three ways to have the dome move.

1. **Manual**: In the 'Move Manually' area, move the cursor to either the '-'(counterclockwise, or east), or '+' (clockwise, or west). **CLICK** and hold down the mouse pointer over the direction you want the dome to move, letting up on the button when the dome is where it is wanted. Note that the dome will 'overshoot' when you release the mouse button, so you might want to release it a few degrees early. There is about +/- 7 degrees of room before the slit might get in the way of the telescope pointing position.

2. **Semi-automatic**: **CLICK** once on the 'Move to Wanted' box. The dome will travel to the wanted position without further user interface. The dome will go the shortest route to the required position, and stop. It will not move until you click the box when needed.

3. **Automatic**: **CLICK** once on the 'Follow Wanted' box. The dome will travel to the wanted position without further user interface, and will automatically move whenever the 'error' gets to approximately a value of +/- 7 degrees. The dome will move whenever you move the telescope anywhere. When 'Follow Wanted' is selected, the box renames itself to 'Stop Following', and shows a **green** symbol (indicating it is active). Also with this selection, the user cannot 'Home' the dome, or manually move the dome, until the 'Stop Following' box is clicked. Whenever the dome moves automatically, it moves ahead about 6 degrees, so that the dome is not moving very often.

Figure B shows the 'Dome' client in the 'Automatic' mode.

29.

Most users select the semi-automatic 'Move to Wanted' option, as the automatic 'Follow Wanted' option moves the dome at anytime, possibly at a time when the image download is taking place. This could result in a failed image download.

DISPLAYING IMAGES

Look at the "Monet 1K Camera Version' client once again:
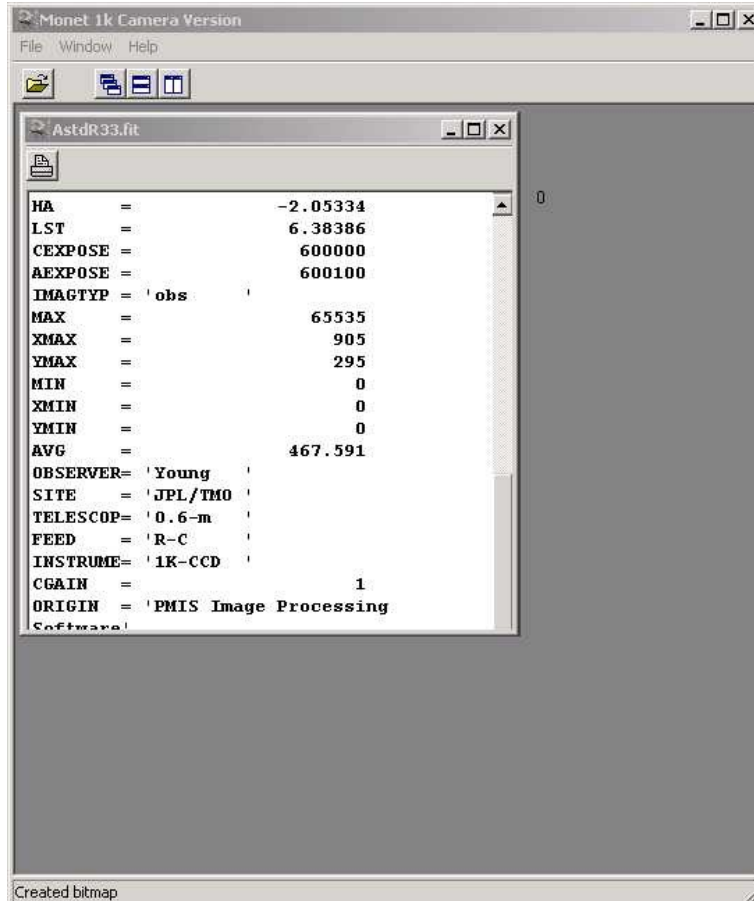
If you wish to display other or previous images while observing, **CLICK** on the 'folder' image in the upper-left corner, to bring up the 'Look in:' folder. You might have to scroll 'back' to get to the proper folder or user by **CLICKING** the 'back folder' icon to the upper right-center to get the appropriate folder, date/time or user.

30.
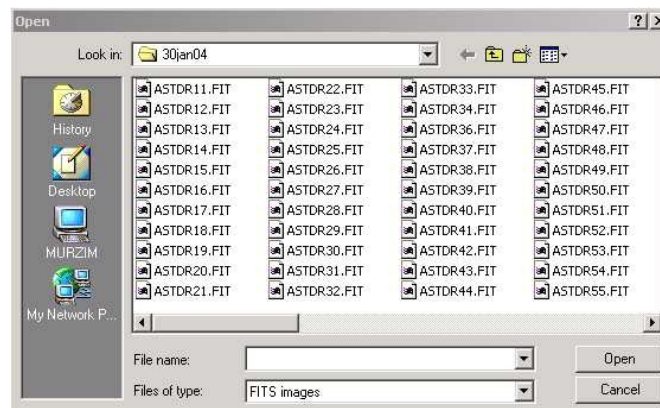
General appearance of the 'Monet' image (heavily stretched for illustration purposes):
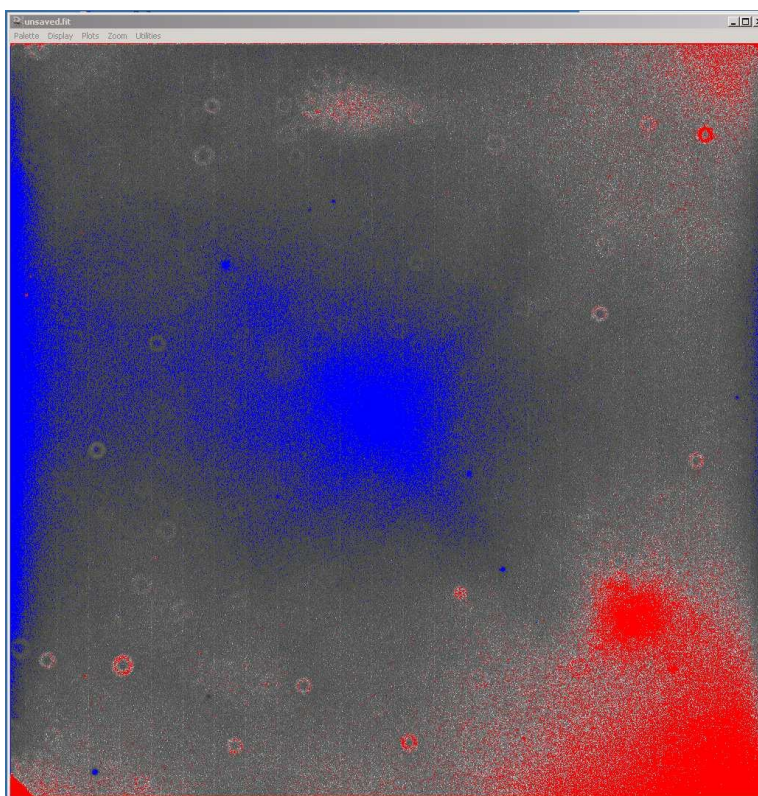
The above example of a 'Monet' displayed image has purposely been taken in some twilight, as well as highly stretched here to illustrate several features of Monet. In this 'negative' image, **blue** indicates an 'above normal' background level; **red** indicating a 'below normal' level. Careful inspection reveals the 'cross' hatched pattern due to the secondary spider supports (which are diagonal in the 0.6 meter telescope), along with the 'hot' spot in the center. There are several 'donut' shaped spots. The smaller 'donuts' are dust specks on the inside of the quartz window of the camera; the slightly larger are on the outside. The extreme corners are slightly vignetted by the circular shape of the opened shutter, being just a small fraction smaller than the diagonal measurement of the camera 1K 'chip'. There are three areas of 'accumulated' fine metal dust particles (from the constant shutter activation); very top center (moderate), lower left center (very little); mid-lower right (extreme). This material is cleaned regularly. On the left edge of the CCD, vertically, is a long 'above-normal' intensity area believed to be part of the 'chip' that never quite gets to temperature (or gets colder for some reason).
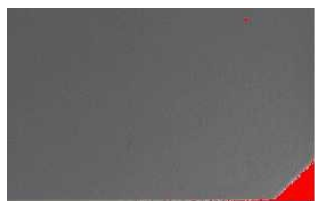
Figure A

Figure B

Figure A illustrates the lower right corner, circular shutter frame edge vignetting. Figure B shows an example of a 'dust' spot on the camera quartz window surface.

31.

#1 TCP: The following 'Login' box is an indication of a network failure, where the length of time to 'Login' has exceeded the normal:

If this occurs at 'Login' for yourself, **CLICK** the 'X' at the upper right to close down the client. **DO NOT** click on the 'OK' box! Although this anomaly is extremely rare, you might happen to encounter it. Try again to 'Login'. Until the 'bogus' numbers go away (no network failure), you will **NOT** be able to run the telescope….at all! In all of the research about this problem, we believe it happens when the network 'switch box' has some sort of failure. After replacing the old 3COM with a 'Cisco' switch box' in late 2003, the problem has not shown up again.

The +70… HA and +874… Dec numbers are consistent with this problem, and no other sets of other numbers were ever seen.

If you inadvertently click on 'OK', TCP will then appear like this:
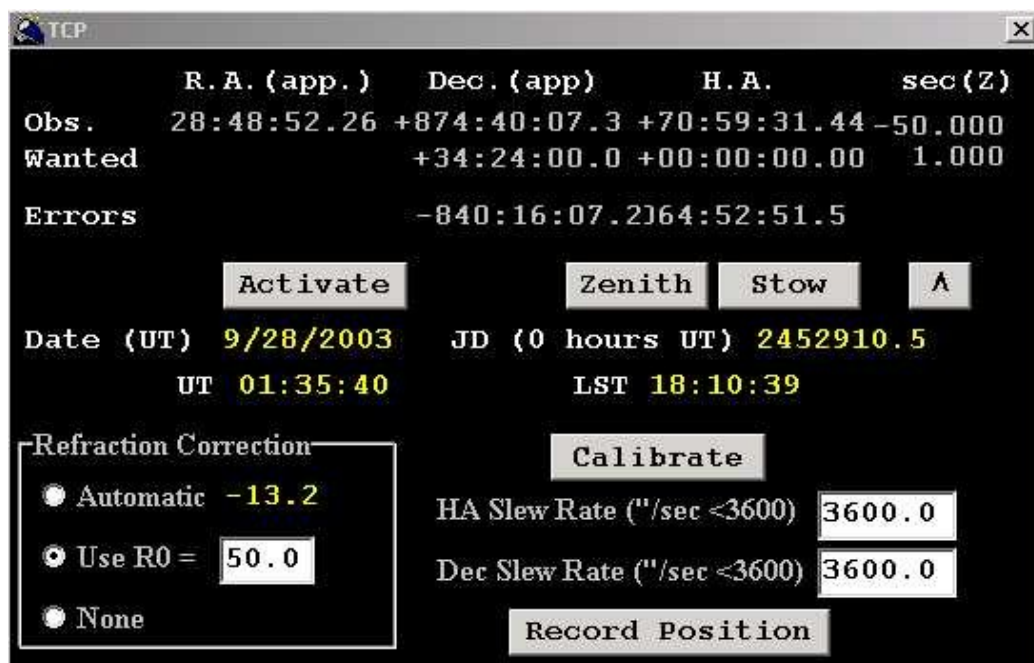
TCP will not work, and 'Activating' the client will not move or slew the telescope. You will need to **CLOSE** down the client, and attempt to start over. There were a few times when this overall problem happened after TCP was up and running all okay! When this occurs, you will note unusually high 'error' numbers (in **red**) under both RA (app.) and Dec. (app.) readings;

32.
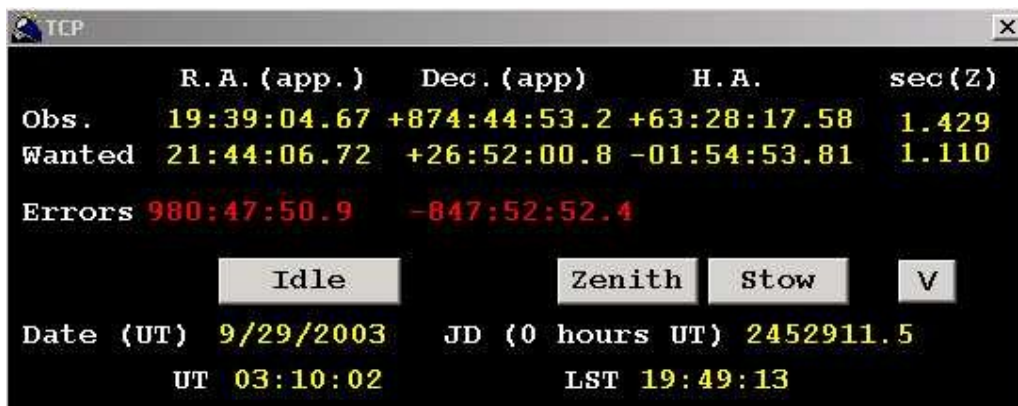
In the event that this happens when TCP is slewing, you will need to immediately HIT the **"EMERGENCY TELESCOPE SHUTDOWN"** button to the left of *Murzim's* monitor on the countertop, otherwise, the telescope will run into the limits, taking it off line until a TMO staff member arrives (after you call the staff member 'on call') to fix the problem. This could cost considerable amount of lost 'science' time for your night!

As with all desktop clients, if during any attempt to close down any client that is no longer responding, it fails to close by clicking on the 'X' at upper right, you will need to go to an empty spot on the computer's taskbar, and **RIGHT-CLICK** the mouse button (shown below with a small **red** arrow):

↑

The 'Windows Task Manager' box will pop-up. **CLICK** on 'Applications, and look for the client you are attempting to close:

33.

Highlight the specific 'client' you are attempting to closedown. Be sure you are on the client you want, because you will otherwise close down some other client that may be in use. You can do this process while running your program, taking exposures, even slewing the telescope…but remember to close down the correct client! In the above illustration, the 1 K Camera client is highlighted, but only as an example. A client that is not operating properly will likely say 'Not Responding' next to it.

CLICK on 'End Task'. The program should end; disappearing from the desktop, as well as no longer appearing in the Task Manager's application list or you might get the following message:

If this message also shows up, **CLICK** on 'End Now' in this box as well. Eventually all message boxes will disappear, and you will then be able to re-start the particular client. The above illustration of any 'This program is not responding' message can occur with any of the clients…this one happens to be of the 'Position' client.

#2 DOME: There are no 'crash' problems associated with the 'Dome' client. On very rare occasions, the 'door' portion of the 'slit' might not open when one selects to 'open' the slit (this command normally opens both the shutter [upper portion] and door [lower portion]). It is recommended that the user always select to 'open' the slit, rather than the 'shutter' and/or 'door' independently. If you experience a partial failure while opening the slit, wait for the system to stop, then close up the 'slit' and try re-opening it. In any case, the user can always use the manual operation to open or close the shutter and/or door operation using the black box in the dome by the main entry door:

Always remember that the 'shutter' must be opened (or closed) before attempting to move the 'door' portion of the slit. In the above illustration, the big **red** knob is an 'Emergency Stop' for all dome operations. On the right, two **red** buttons control the 'shutter' and 'door' opening; each is independent of the other. On the left, two **green** buttons control the closing. The two white buttons manually move the dome left or right. Also remember that the dome **MUST** be in the 'Home' position before the 'shutter' and/or 'door' can be moved (as illustrated below):

35.
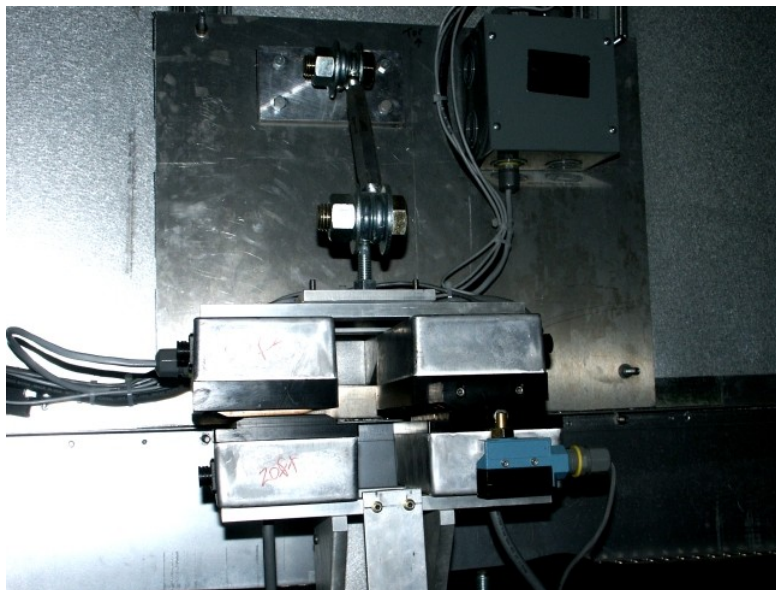
If the dome is not in the 'Home' position,

you will need to **PRESS** the appropriate white button to center the two upper contacts (that are mounted on the dome itself) with the two lower contacts (mounted on the wall), which will then provide the 220VAC to the 'shutter' and 'door' motors for movement control.

#3 POSITIONS: There are no known problems associated with this client.

#4 PADDLE: There are no known problems associated with this client.

#5 FOCUS: The 'focus' client crashes once or twice during a full night's run. We believe it is associated with network bandwidth, noise, or some sort of interrupts. The only clue the user will see, is an inactivity of the frequent changes of the temperature and focus numbers. This can be quite subtle, so always keep an eye on the numbers to confirm its activity. Since everyone must use the 'Set' box to focus frequently (recommended before every image exposure), little time will pass before the user will notice if there is a problem. If it crashes, use 'Task Manager' to close the client (if clicking on the 'X' doesn't work). Then re-start the client.

#6 VIDEO: There are no known problems associated with this client.

#7 PMIS: PMIS crashes are very infrequent, but completely stops the user from taking any images. The only immediate clue the user will see, will be the disappearance of the small PMIS 'Camera' CCD display (shown here again for identification only);
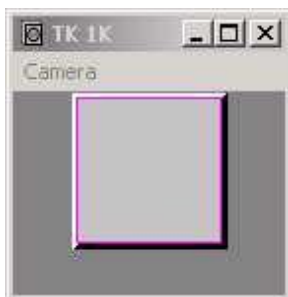
Un-minimize the PMIS client (from the taskbar), then close the client. You may need to use the 'Task Manager' to close PMIS. You must then close the 1K client as well (which will close the 'Monet' display). Re-open both PMIS and the 1K Camera clients (in that order), remembering to follow the instructions in the previous section about opening these clients. Another important reminder here is to re-set your 1K Camera client 'Seq.#' to the appropriate number, filter, etc. None of this will affect other clients already currently in operation; not even telescope tracking!

#8 1K CAMERA: There are no known problems directly associated with this client, however, remember that this client brings up the 'Monet 1K Camera Version' display box. There are times when this display box fails to register images while attempting to display them. When this occurs, the following will appear (just like in the earlier discussion if accessing the small 'Camera' CCD display menu); (again, ignore the 'Label1' on the screen)
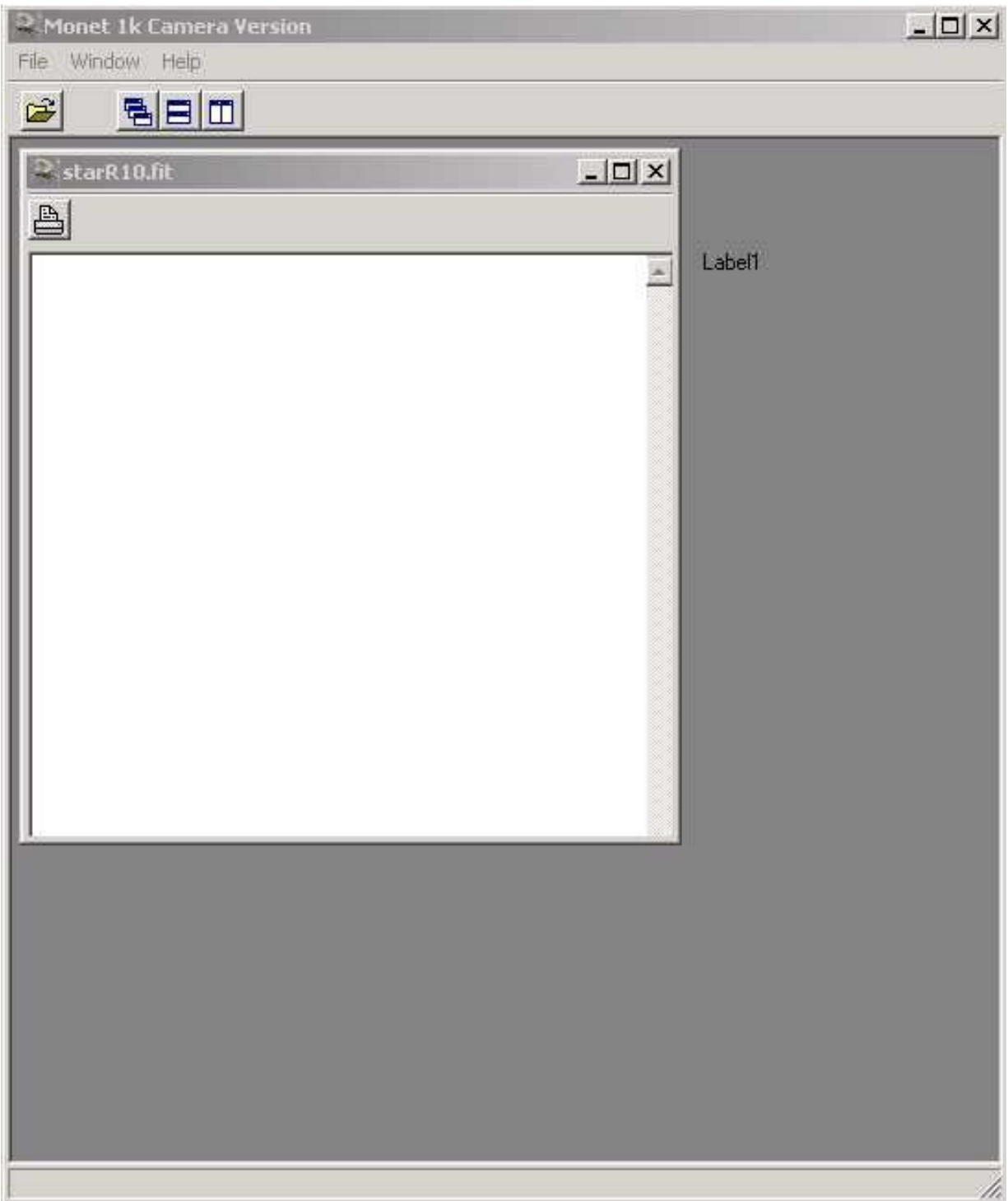
But in the case, you will need to close the 1K Camera client, and re-start it. PMIS will not be affected. Again, don't forget to re-set the client's 'Seq.#', filter, etc.

RELAY BOARD SETTINGS

Several control 'clients' make use of individual relays to control other needs while observing. while observing. Note that users should NOT attempt to manually set any relay. The following is provided for in formation only. The 'Relay Board', in the control room behind _Murzim's_ monitor, is pictured here again
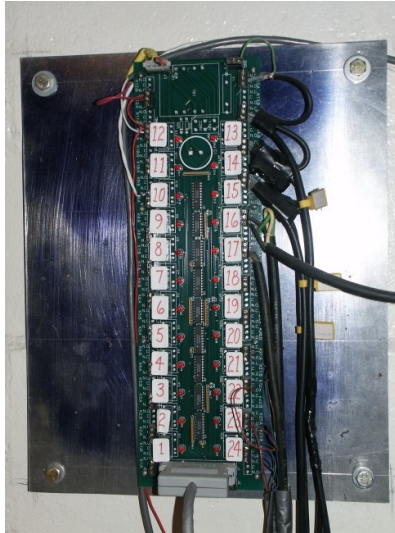
The various 'numbered' relays are as follows;

1. N/C
2. N/C
3. N/C
4. N/C
5. N/C
6. N/C
7. N/C
8. N/C
9. Pulnix Video Camera power on
10. N/C
11. Open telescope 'Mirror Cover'
12. Close telescope 'Mirror Cover'
13. Wide Field video camera (not installed)
14. Pulnix Video output to RCA monitor
15. Spare Video outlet
16. Dome Video output to RCA monitor
17. Calibration lights turned on (mounted on front end of telescope)
18. TCP client running (Controls the red flashing light by TM-12's front door entrance. This is used to alert the TMF staff not to enter the upper or lower 'silo' portions of the dome.)
19. N/C
20. N/C
21. N/C
22. N/C
23. N/C
24. N/C

Whenever a user turns on TCP (either a local user, or a remote one), relay #18 turns on, which in turn begins the 'flashing' red light outside the TM-12 entrance to alert any TMF/TMO staff that the 0.6 meter telescope is being used.

The other main uses of the relays are to control the video devices (the Pulnix and Dome cameras) as well as opening and closing the telescope 'mirror cover'. The important caution is to always remember NOT to access either the videos or the 'mirror cover' at the same time. If you are opening the telescope cover, wait until the relay turns off before accessing either of the two video cameras….and vice versa. If you do not, the 'mirror cover' will stop (whether you are opening or closing it). This will force you to close down the dome client, and re-start it just to complete the 'mirror cover' cycle.

There is NO user access to the settings and use of this board.

OTHER ERROR MESSAGES

If you attempt to open the eight program clients out-of-order, you will encounter several 'error' messages. These messages are shown here for illustration purposes only, so that if you accidentally 'goof' on the order, you will at least understand what they mean.

If TCP is not running, and you attempt to open other clients, you will encounter the following:
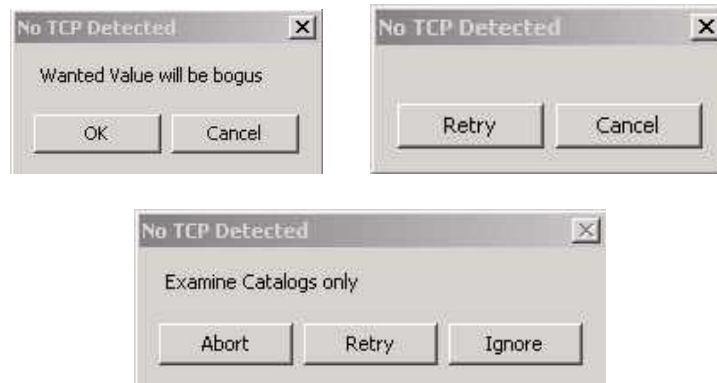
With the 'Dome' client, if one attempts to 'open' the slit after the 'mirror cover' is already opened, you will receive the following error (shown in figure A):

Figure A   **Figure B**

In figure B, the mirror cover has failed (usually because the user has attempted to perform some other function involving the 'Relay Board' on the wall behind *Murzim's* monitor. If this is the case, the 'dome' client will appear as follows (in figure A below):

<div align="center">

Figure A   **Figure B**

</div>

Close-down the client then re-open. You will get the 'dome' client as shown in figure B. Open the 'cover' (then close it if that was your original intention) and continue operations as normal.
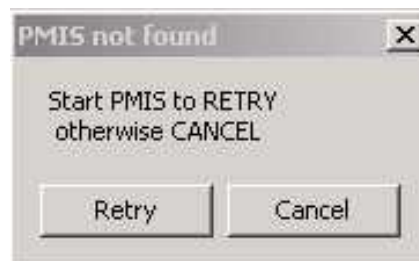
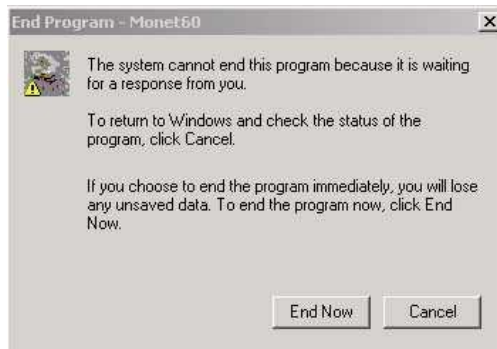Other errors associated with the dome client are as follows:

A Positions client 'error' will show if you attempt to load a position without TCP running:

If you attempt to open the 1K Camera client without PMIS up an running, you will get:

The following 'error' message may show itself occasionally when the 'Monet' client crashes:

<div align="center">

40.

</div>

CLICK on 'End Now'. Sometimes it takes more than one 'click' to close this message. You May also have to use 'Task Manager' to close the problem.

MIRROR COVER APPEARANCE / AJAR (PICTURES)

Figure A   **Figure B**

Figure A shows the mirror cover closed: figure B shows it properly opened. Below in figure C, it is 'ajar'. If the cover gets hung up in the 'ajar' position, you must close the 'Dome' client down and then re-start it to finish the open (or close) operation:


Figure C
**41.**

ADDITIONAL PICTURES

Dome Air Conditioning

This is the air conditioning control in the dome itself. At the right is the 'toggle' switch that controls the AC unit (in this picture, the toggle is up, indicating the AC is turned on). Just below the center in the picture is a small white colored round knob. This is the temperature control setting. It is often useful to have a small flashlight to be able to read the values on the knob. If you are accessing the AC, remember to turn the unit on when you leave after your night's telescope run. Be sure you set the temperature to the approximate outside temperature you expect it to be for you next night's run. Turn the AC off before you start observing.
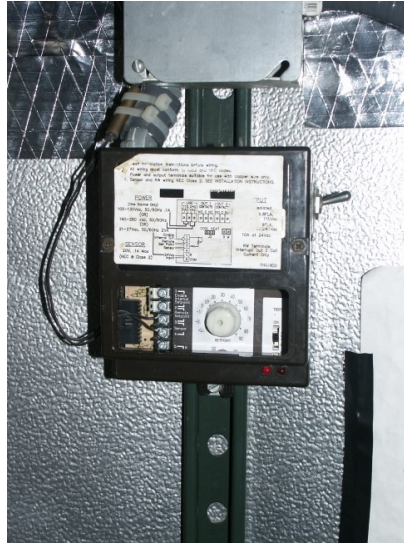
Whenever turning the unit off, you **MUST** turn the white knob to the warmest setting (this is a 'clockwise' turn), and wait 10 minutes before turning off the toggle switch. It is advised that you re-set the temperature to what is expected the next night after you turn off the switch. This will help prevent you from forgetting to set the temperature later in the morning when you leave.

Zenith and Meridian LED Indicators
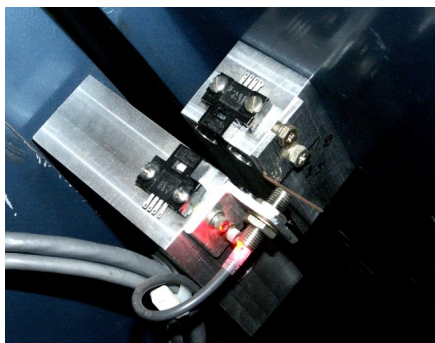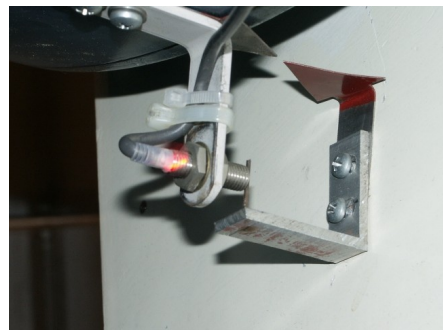
0.0 HA (Meridian)   34º 24' (Zenith)

These two indicators help the TMO staff keep the telescope properly calibrated. When the telescope is in the zenith position and the LEDs are lit (red), then each axis is correctly calibrated. Users can check this by slewing the telescope to 0.0 HA and the 'zenith'.

In order to fill the CCD camera dewar with LN$_2$, the user must raise the floor using the control box on the small desk in the dome:

<div style="text-align:center">Figure A</div>

<div style="text-align:center">Figure B</div>

The lower silver aluminum box is pictured in figures A and B, which show the controls for the floor and the interior lights. In the back of this box is a 'warning horn' button to push before you raise (or lower) the floor. This is a safety requirement set by OSHA standards. **USE IT!** Hold the button down for 2-3 seconds anytime you plan to move the floor. This will alert anyone downstairs that you are about ready to raise (or lower) the floor.

The 'toggle' switch turns off the lights in the dome. The other 'dome rotation' buttons are no longer used. The manual control for rotating the dome is done from the 'black' box on the same desk, just above the silver box (and previously described).

<div style="text-align:center">Emergency Telescope Shutdown Button in the Dome</div>

The 'Emergency Telescope Shutdown' button is located on the west side of the telescope pier (towards the Control Room door). Use this 'Shutdown' button to terminate a telescope slew should the telescope inadvertently 'take off' while you are in the dome. This button operates the same as the one in the control room next to *Murzim's* monitor.

The Pulnix Video Camera

This is the Pulnix video camera, which shows the area of the sky where the telescope is pointing. With a clear night and good seeing, it captures stars down to about 14th magnitude. It is fairly well centered on the control room's RCA monitor screen. Whenever you are filling the CCD camera with LN2, please be extremely cautious NOT to bump into the camera housing; the display monitor is centered, and the slightest 'jar' will change that position. Also remember that The Pulnix **MUST** be turned off using the 'Video' client on *Murzim* **BEFORE** you turn on any dome light, or iftwilight is too intense. The Pulnix camera is now housed in a protective cover at the base of the 6-inch finder telescope.

Filter Box 'Red' Warning LED
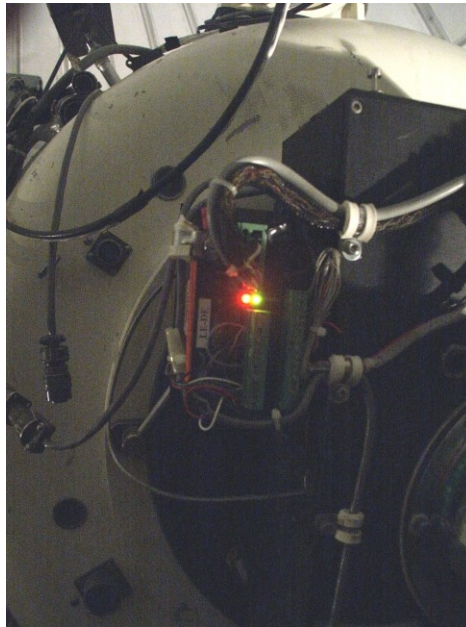
Sometimes when the power goes out, or some power anomaly occurs during the day, you might find the filter box has a 'red' warning LED showing. You need to unplug the AC power cable to the unit, and then re-plug the cable back into the AC power source (mounted on the telescope).

The 'black' box mounted on the east side of the telescope pier is the network connection that controls the motion (slew and track) of the 0.6 meter telescope. A '**red**' LED indicator will alert you to any problems (also associated with a power failure, or loss of a network connection).

## WORSE CASE SENARIO - PMIS SECURITY CRASH

History

The software program that came with the 1K CCD Camera, PMIS, has an unusual security 'hardware key'. The company that produced this software made it so that users could put the software on all the computers they could ever want, but the software would not work unless the 'key' was physically installed on the computer. The cost for the software included only one 'key'. This key is a plug-in device that resides on the computer using the program; namely, *Murzim*. It is plugged into the LPT1 port; the 'printer' port. Although there is no printer attached directly to *Murzim*, this 'key' acts as a security measure to the software vendor to assure them that only the program on a single computer can be used at any one time.

For some reason, unknown to the TMO staff, on extremely rare occasions this 'key' is not seen during the use of PMIS. It may be a network 'glitch', but when it happens, the user will see:

45.

This difficulty has happened on only three occasions that we are aware of, so the work around needed to correct the problem is not completely known. It's suspected that there is some accumulation of errors if the user continues taking images (using PMIS). Eventually, the following appears:
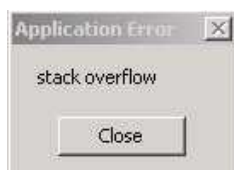
When this window pops up on the screen, then things start to happen. The small Camera Chip Display disappears from the screen, and you CANNOT re-open PMIS! Remember that if PMIS goes down, you also must shutdown the 1K Camera client. But in this case, you CANNOT close the computer down to do a 'restart'. If you attempt to do so, you will get several error messages even inaccessible to our screen capture imaging program (thus we cannot display them).

<div align="center">Re-start Procedure</div>

All other clients are still operational at this stage. 'Home' the telescope to the 'stow' position. Close all clients down, including the 'dome' client. You do not need to 'home' the dome, or even close it. The 'dome' client will give you three error messages when you attempt to close it, however, just hit the 'cancel' buttons until the client closes;

When all the clients are closed, go downstairs to the 'computer room' (directly underneath the telescope control room (to the left of the restroom door). Locate the computer, *Murzim*, and press the **red** colored 'RESTART' button only once! DO NOT touch anything else! Return to the telescope control room, and wait for *Murzim* to re-boot. Restart everything, and return to your observing. The following images are of the control room 'computer 'rack' and *Murzim*:

<div align="center">**46.**</div>

Hard-Disk Drive Full!

If the HDD drive is full to capacity (Disk 'D' on Murzim), any auto-saved image attempts with PMIS will fail with a crash of the header file(s), showing a horizontal bar at the top of the frame as displayed in 'Monet'. The file cannot be read in 'Astrometrica' or 'DS9' programs. You will have to delete some files from your directory (to CD or DVD) before being able to continue. Jim keeps the files at a minimum as necessary to avoid this problem.

PUBLICATIONS

Publications resulting from observations made at JPL's Table Mountain Observatory need to state the following in the 'acknowledgement' section;